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Supplementary appendix

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Supplementary material - An external validation of the QCovid risk prediction algorithm for risk of mortality from COVID-19 in adults: national validation cohort study in England

Appendix

Supplementary Table 1: Population and Covid-19 deaths in the ONS Public Health Data Asset compared to England (up to 28th July 2020)

	Population			COVID-19 deaths		
	In the Cohort	England	Proportion	Recorded in the Cohort	Recorded in England	Proportion
East Midlands	3,137,521	3,779,186	83.0%	3,351	3,977	84.3%
East of England	3,987,067	4,822,148	82.7%	4,005	5,113	78.3%
London	4,662,731	6,834,636	68.2%	6,359	8,570	74.2%
North East	1,755,316	2,108,996	83.2%	2,360	2,834	83.3%
North West	4,643,947	5,696,784	81.5%	6,700	7,923	84.6%
South East	5,818,470	7,107,605	81.9%	6,123	7,374	83.0%
South West	3,674,549	4,457,165	82.4%	2,402	2,916	82.4%
West Midlands	3,643,447	4,566,619	79.8%	4,781	5,898	81.1%
Yorkshire & Humber	3,574,600	4,271,381	83.7%	4,081	4,856	84.0%
England	34,897,648	43,644,520	80.0%	40,162	49,461	81.2%

Note: Population for England and deaths that occurred in England are for people 19 or over, whilst our cohort is limited to people aged between 19 and 100. Source: Population for England: [Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland](#) (ONS); Deaths in England: [Deaths registered weekly in England and Wales, provisional](#) (ONS).

Supplementary Table 2: Performance of the risk models to predict risk of COVID-19 death in 14,104,452 patients registered with practices using the TPP System

	Period 1 (24/01/2020 - 30/04/2020)		Period 2 (01/05/2020 - 28/07/2020)	
	COVID -19 death females	COVID -19 death males	COVID -19 death females	COVID -19 death males
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
R ² statistic	0.778 (0.773 to 0.783)	0.785 (0.780 to 0.790)	0.769 (0.763 to 0.775)	0.766 (0.760 to 0.772)
D statistic	3.833 (3.775 to 3.892)	3.911 (3.857 to 3.965)	3.731 (3.669 to 3.793)	3.704 (3.639 to 3.769)
Harrell's C statistic	0.945 (0.942 to 0.948)	0.934 (0.931 to 0.937)	0.957 (0.953 to 0.960)	0.948 (0.945 to 0.952)
Brier score	0.0011	0.0015	0.0007	0.0008

Supplementary Table 3: Performance of the risk models to predict risk of COVID-19 death in patients registered with valid BMI information

	Period 1 (24/01/2020 -30/04/2020)		Period 2 (01/05/2020 -28/07/2020)	
	COVID -19 death females	COVID -19 death males	COVID -19 death females	COVID -19 death males
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
R ² statistic (%)	0.752 (0.748 to 0.756)	0.767 (0.763 to 0.770)	0.765 (0.760 to 0.770)	0.752 (0.746 to 0.758)
D statistic	3.564 (3.525 to 3.604)	3.711 (3.673 to 3.750)	3.693 (3.637 to 3.749)	3.564 (3.505 to 3.623)
Harrell's C statistic	0.944 (0.942 to 0.946)	0.926 (0.924 to 0.929)	0.955 (0.952 to 0.957)	0.933 (0.930 to 0.937)
Brier score	0.0013	0.0023	0.0007	0.0009

Supplementary Table 4: Performance of the risk models to predict risk of COVID-19 death between 01/05/2020 and 30/06/2020

	01/05/2020 -30/06/2020	
	COVID -19 death females	COVID -19 death males
	Estimate (95% CI)	Estimate (95% CI)
R ² statistic (%)	0.766 (0.762 to 0.769)	0.771 (0.767 to 0.775)
D statistic	3.699 (3.660 to 3.738)	3.752 (3.709 to 3.796)
Harrell's C statistic	0.956 (0.954 to 0.958)	0.945 (0.942 to 0.947)
Brier score	0.0007	0.0007

Supplementary Table 5: Performance of the risk models to predict risk of COVID-19 death in the validation cohort by subgroup using Harrell's C statistic (95% CI).

	Period 1 (24/01/2020 -30/04/2020)		Period 2 (01/05/2020 -28/07/2020)	
	COVID -19 death females	COVID -19 death males	COVID -19 death females	COVID -19 death males
Age band				

19-40	0.810 (0.753 to 0.866)	0.833 (0.784 to 0.881)	0.800 (0.676 to 0.925)	0.786 (0.685 to 0.886)
40-45	0.856 (0.798 to 0.913)	0.811 (0.758 to 0.865)	0.746 (0.659 to 0.833)	0.763 (0.667 to 0.860)
45-50	0.849 (0.808 to 0.890)	0.841 (0.809 to 0.872)	0.809 (0.723 to 0.895)	0.768 (0.692 to 0.843)
50-55	0.874 (0.847 to 0.901)	0.834 (0.808 to 0.860)	0.782 (0.716 to 0.849)	0.779 (0.731 to 0.827)
55-60	0.844 (0.819 to 0.869)	0.796 (0.774 to 0.818)	0.805 (0.754 to 0.856)	0.809 (0.776 to 0.842)
60-65	0.851 (0.831 to 0.872)	0.808 (0.791 to 0.825)	0.818 (0.777 to 0.858)	0.788 (0.758 to 0.819)
65-70	0.844 (0.826 to 0.861)	0.803 (0.789 to 0.817)	0.787 (0.755 to 0.819)	0.817 (0.794 to 0.839)
70-75	0.851 (0.837 to 0.865)	0.796 (0.785 to 0.807)	0.857 (0.838 to 0.876)	0.826 (0.810 to 0.842)
75-80	0.846 (0.835 to 0.857)	0.808 (0.798 to 0.817)	0.839 (0.824 to 0.855)	0.821 (0.807 to 0.835)
80-85	0.819 (0.810 to 0.828)	0.787 (0.779 to 0.796)	0.828 (0.816 to 0.840)	0.803 (0.791 to 0.815)
85-90	0.793 (0.784 to 0.802)	0.768 (0.759 to 0.777)	0.785 (0.774 to 0.797)	0.755 (0.742 to 0.769)
90+	0.736 (0.727 to 0.744)	0.729 (0.719 to 0.740)	0.750 (0.740 to 0.760)	0.720 (0.705 to 0.735)
Ethnicity				
Bangladeshi	0.942 (0.918 to 0.966)	0.939 (0.921 to 0.957)	0.932 (0.891 to 0.973)	0.918 (0.863 to 0.974)
Black African	0.888 (0.859 to 0.917)	0.906 (0.888 to 0.925)	0.839 (0.743 to 0.935)	0.908 (0.870 to 0.946)
Black Caribbean	0.924 (0.912 to 0.937)	0.930 (0.920 to 0.939)	0.939 (0.914 to 0.965)	0.921 (0.890 to 0.951)
Chinese	0.960 (0.937 to 0.984)	0.914 (0.877 to 0.950)	0.927 (0.861 to 0.993)	0.955 (0.913 to 0.997)
Indian	0.939 (0.929 to 0.949)	0.916 (0.906 to 0.926)	0.929 (0.907 to 0.950)	0.901 (0.878 to 0.924)
Mixed	0.947 (0.923 to 0.972)	0.972 (0.961 to 0.984)	0.980 (0.966 to 0.994)	0.963 (0.946 to 0.979)
Other	0.935 (0.919 to 0.950)	0.905 (0.892 to 0.918)	0.883 (0.826 to 0.939)	0.905 (0.880 to 0.930)
Pakistani	0.918 (0.899 to 0.937)	0.923 (0.908 to 0.937)	0.948 (0.926 to 0.971)	0.897 (0.865 to 0.930)
White British	0.946 (0.944 to 0.948)	0.935 (0.933 to 0.937)	0.956 (0.954 to 0.958)	0.947 (0.944 to 0.949)
White other	0.963 (0.956 to 0.969)	0.950 (0.943 to 0.957)	0.968 (0.956 to 0.981)	0.951 (0.939 to 0.963)
Townsend quintile				
1 (most affluent)	0.945 (0.940 to 0.949)	0.933 (0.929 to 0.937)	0.961 (0.957 to 0.965)	0.949 (0.944 to 0.954)
2	0.945 (0.940 to 0.949)	0.935 (0.932 to 0.939)	0.955 (0.951 to 0.960)	0.947 (0.942 to 0.952)

3	0.947 (0.943 to 0.951)	0.933 (0.929 to 0.937)	0.958 (0.954 to 0.963)	0.945 (0.940 to 0.950)
4	0.946 (0.942 to 0.949)	0.938 (0.935 to 0.942)	0.956 (0.952 to 0.960)	0.944 (0.939 to 0.950)
5 (most deprived)	0.943 (0.939 to 0.947)	0.934 (0.930 to 0.937)	0.952 (0.946 to 0.957)	0.936 (0.930 to 0.942)

Supplementary Table 6: D statistic of the risk models to predict risk of COVID-19 death in the validation cohort by subgroup

	Period 1 (24/01/2020 -30/04/2020)		Period 2 (01/05/2020 -28/07/2020)	
	COVID -19 death	COVID -19 death	COVID -19 death	COVID -19 death
	females	males	females	males
Age band				
19-40	2.175 (1.808 to 2.541)	2.551 (2.192 to 2.910)	2.376 (1.631 to 3.121)	1.857 (1.230 to 2.484)
40-45	2.537 (2.052 to 3.022)	2.212 (1.826 to 2.598)	1.360 (0.641 to 2.078)	1.573 (0.942 to 2.204)
45-50	2.660 (2.320 to 3.001)	2.331 (2.053 to 2.610)	1.966 (1.426 to 2.505)	1.865 (1.401 to 2.329)
50-55	2.627 (2.378 to 2.876)	2.355 (2.144 to 2.566)	1.961 (1.522 to 2.400)	1.780 (1.462 to 2.099)
55-60	2.434 (2.226 to 2.641)	2.099 (1.943 to 2.255)	1.946 (1.607 to 2.285)	2.028 (1.773 to 2.283)
60-65	2.603 (2.427 to 2.779)	2.260 (2.129 to 2.390)	2.003 (1.734 to 2.271)	1.923 (1.713 to 2.133)
65-70	2.433 (2.284 to 2.583)	2.299 (2.185 to 2.414)	1.904 (1.694 to 2.115)	2.094 (1.918 to 2.269)
70-75	2.735 (2.610 to 2.860)	2.273 (2.182 to 2.365)	2.668 (2.497 to 2.839)	2.405 (2.268 to 2.541)
75-80	2.609 (2.513 to 2.705)	2.241 (2.168 to 2.314)	2.454 (2.318 to 2.590)	2.297 (2.187 to 2.408)
80-85	2.304 (2.229 to 2.378)	2.135 (2.071 to 2.199)	2.285 (2.188 to 2.382)	2.218 (2.123 to 2.312)
85-90	2.011 (1.945 to 2.077)	1.800 (1.739 to 1.861)	1.945 (1.861 to 2.030)	1.739 (1.652 to 1.826)
90+	1.444 (1.385 to 1.503)	1.446 (1.381 to 1.511)	1.327 (1.263 to 1.392)	1.347 (1.254 to 1.440)
Ethnicity				
Bangladeshi	3.370 (2.920 to 3.820)	4.803 (4.345 to 5.261)	3.666 (2.323 to 5.010)	2.828 (2.073 to 3.582)
Black African	3.560 (3.199 to 3.920)	3.435 (3.196 to 3.675)	2.648 (1.845 to 3.451)	2.739 (2.247 to 3.232)
Black Caribbean	3.973 (3.692 to 4.254)	3.426 (3.259 to 3.594)	3.670 (3.075 to 4.266)	3.314 (2.922 to 3.705)
Chinese	4.408 (3.753 to 5.063)	4.730 (4.068 to 5.393)	6.309 (4.459 to 8.160)	4.571 (3.063 to 6.079)
Indian	3.504 (3.304 to 3.704)	3.338 (3.186 to 3.490)	3.705 (3.289 to 4.121)	2.826 (2.504 to 3.148)
Mixed	4.039 (3.612 to 4.466)	4.171 (3.818 to 4.525)	5.267 (4.447 to 6.086)	3.900 (3.336 to 4.464)
Other	3.994 (3.701 to 4.286)	3.725 (3.502 to 3.948)	3.317 (2.786 to 3.848)	3.070 (2.640 to 3.500)
Pakistani	3.567 (3.240 to 3.895)	3.381 (3.148 to 3.615)	3.362 (2.832 to 3.892)	2.623 (2.267 to 2.979)
White British	3.487 (3.456 to 3.517)	3.761 (3.729 to 3.792)	3.595 (3.556 to 3.633)	3.993 (3.945 to 4.041)

White other	3.749 (3.614 to 3.884)	4.007 (3.857 to 4.158)	3.902 (3.667 to 4.137)	4.223 (3.929 to 4.517)
Townsend quintile				
1 (most affluent)	3.667 (3.591 to 3.744)	3.738 (3.674 to 3.803)	3.954 (3.863 to 4.045)	4.253 (4.153 to 4.353)
2	3.905 (3.826 to 3.985)	3.875 (3.809 to 3.940)	3.640 (3.558 to 3.722)	3.686 (3.605 to 3.766)
3	3.764 (3.690 to 3.838)	4.006 (3.931 to 4.082)	3.819 (3.727 to 3.911)	3.562 (3.476 to 3.647)
4	3.364 (3.304 to 3.424)	4.070 (3.997 to 4.143)	3.803 (3.706 to 3.899)	3.664 (3.570 to 3.758)
5 (most deprived)	3.274 (3.218 to 3.330)	3.920 (3.854 to 3.985)	3.601 (3.509 to 3.693)	3.696 (3.585 to 3.807)

Supplementary Table 7: R-squared of the risk models to predict risk of COVID-19 death in the validation cohort by subgroup

	Period 1 (24/01/2020 -30/04/2020)		Period 2 (01/05/2020 -28/07/2020)	
	COVID -19 death females	COVID -19 death males	COVID -19 death females	COVID -19 death males
Age band				
19-40	0.530 (0.438 to 0.607)	0.608 (0.534 to 0.669)	0.574 (0.388 to 0.699)	0.451 (0.265 to 0.596)
40-45	0.606 (0.501 to 0.686)	0.539 (0.443 to 0.617)	0.306 (0.089 to 0.508)	0.371 (0.175 to 0.537)
45-50	0.628 (0.562 to 0.683)	0.565 (0.502 to 0.619)	0.480 (0.327 to 0.600)	0.454 (0.319 to 0.564)
50-55	0.622 (0.574 to 0.664)	0.570 (0.523 to 0.611)	0.479 (0.356 to 0.579)	0.431 (0.338 to 0.513)
55-60	0.586 (0.542 to 0.625)	0.513 (0.474 to 0.548)	0.475 (0.382 to 0.555)	0.495 (0.429 to 0.554)
60-65	0.618 (0.584 to 0.648)	0.549 (0.520 to 0.577)	0.489 (0.418 to 0.552)	0.469 (0.412 to 0.521)
65-70	0.586 (0.555 to 0.614)	0.558 (0.533 to 0.582)	0.464 (0.407 to 0.516)	0.511 (0.468 to 0.551)
70-75	0.641 (0.619 to 0.661)	0.552 (0.532 to 0.572)	0.630 (0.598 to 0.658)	0.580 (0.551 to 0.607)
75-80	0.619 (0.601 to 0.636)	0.545 (0.529 to 0.561)	0.590 (0.562 to 0.616)	0.558 (0.533 to 0.581)
80-85	0.559 (0.543 to 0.574)	0.521 (0.506 to 0.536)	0.555 (0.533 to 0.575)	0.540 (0.518 to 0.561)
85-90	0.491 (0.475 to 0.507)	0.436 (0.419 to 0.452)	0.475 (0.453 to 0.496)	0.419 (0.394 to 0.443)
90+	0.332 (0.314 to 0.350)	0.333 (0.313 to 0.353)	0.296 (0.276 to 0.316)	0.302 (0.273 to 0.331)
Ethnicity				
Bangladeshi	0.731 (0.671 to 0.777)	0.846 (0.818 to 0.869)	0.762 (0.563 to 0.857)	0.656 (0.506 to 0.754)
Black African	0.752 (0.710 to 0.786)	0.738 (0.709 to 0.763)	0.626 (0.448 to 0.740)	0.642 (0.547 to 0.714)
Black Caribbean	0.790 (0.765 to 0.812)	0.737 (0.717 to 0.755)	0.763 (0.693 to 0.813)	0.724 (0.671 to 0.766)
Chinese	0.823 (0.771 to 0.860)	0.842 (0.798 to 0.874)	0.905 (0.826 to 0.941)	0.833 (0.691 to 0.898)
Indian	0.746 (0.723 to 0.766)	0.727 (0.708 to 0.744)	0.766 (0.721 to 0.802)	0.656 (0.600 to 0.703)
Mixed	0.796 (0.757 to 0.826)	0.806 (0.777 to 0.830)	0.869 (0.825 to 0.898)	0.784 (0.727 to 0.826)
Other	0.792 (0.766 to 0.814)	0.768 (0.745 to 0.788)	0.724 (0.649 to 0.780)	0.692 (0.625 to 0.745)
Pakistani	0.752 (0.715 to 0.784)	0.732 (0.703 to 0.757)	0.730 (0.657 to 0.783)	0.622 (0.551 to 0.679)
White British	0.744 (0.740 to 0.747)	0.771 (0.768 to 0.774)	0.755 (0.751 to 0.759)	0.792 (0.788 to 0.796)

White other	0.770 (0.757 to 0.783)	0.793 (0.780 to 0.805)	0.784 (0.762 to 0.803)	0.810 (0.787 to 0.830)
Townsend quintile				
1 (most affluent)	0.763 (0.755 to 0.770)	0.769 (0.763 to 0.775)	0.789 (0.781 to 0.796)	0.812 (0.805 to 0.819)
2	0.785 (0.777 to 0.791)	0.782 (0.776 to 0.787)	0.760 (0.751 to 0.768)	0.764 (0.756 to 0.772)
3	0.772 (0.765 to 0.779)	0.793 (0.787 to 0.799)	0.777 (0.768 to 0.785)	0.752 (0.743 to 0.760)
4	0.730 (0.723 to 0.737)	0.798 (0.792 to 0.804)	0.775 (0.766 to 0.784)	0.762 (0.753 to 0.771)
5 (most deprived)	0.719 (0.712 to 0.726)	0.786 (0.780 to 0.791)	0.756 (0.746 to 0.765)	0.765 (0.754 to 0.776)

Supplementary Table 8: Brier score the risk models to predict risk of COVID-19 death in the validation cohort by subgroup

	Period 1 (24/01/2020 - 30/04/2020)		Period 2 (01/05/2020 - 28/07/2020)	
	females	males	females	males
Age band				
19-40	0.00003	0.00003	0.00001	0.00001
40-45	0.00007	0.00011	0.00003	0.00004
45-50	0.00013	0.00020	0.00004	0.00007
50-55	0.00021	0.00034	0.00006	0.00013
55-60	0.00033	0.00062	0.00011	0.00021
60-65	0.00057	0.00110	0.00020	0.00036
65-70	0.00083	0.00178	0.00037	0.00058
70-75	0.00136	0.00284	0.00063	0.00111
75-80	0.00295	0.00551	0.00142	0.00235
80-85	0.00599	0.01058	0.00332	0.00494
85-90	0.01037	0.01779	0.00671	0.00887
90+	0.01882	0.02999	0.01419	0.01743
Ethnicity				
Bangladeshi	0.00081	0.00193	0.00015	0.00032
Black African	0.00099	0.00213	0.00013	0.00038
Black Caribbean	0.00253	0.00534	0.00041	0.00100
Chinese	0.00076	0.00155	0.00031	0.00026
Indian	0.00121	0.00218	0.00041	0.00052
Mixed	0.00054	0.00079	0.00020	0.00029
Other	0.00097	0.00184	0.00025	0.00039
Pakistani	0.00087	0.00161	0.00024	0.00050
White British	0.00130	0.00178	0.00080	0.00085
White other	0.00100	0.00160	0.00038	0.00051

Townsend quintile				
1 (most affluent)	0.00104	0.00161	0.00069	0.00082
2	0.00108	0.00165	0.00071	0.00082
3	0.00125	0.00171	0.00074	0.00079
4	0.00142	0.00186	0.00075	0.00077
5 (most deprived)	0.00155	0.00229	0.00067	0.00074

Supplementary Table 9 Sensitivity for covid-19 related death by sex at different absolute risk thresholds

Top centile	Total patients in each centile	Absolute risk centile cut-off (%)	Total deaths in each absolute risk centile	Cumulative % deaths based on absolute risk (sensitivity [†])
Men, Period 1 (24 January 2020 to 30 April 2020)				
1	165998	0.9195	5169	33.71
2	165999	0.5593	1968	46.54
3	165999	0.4197	1327	55.20
4	165999	0.3414	926	61.24
5	165998	0.2890	721	65.94
6	165999	0.2506	578	69.71
7	165999	0.2207	472	72.79
8	165999	0.1965	390	75.33
9	165998	0.1763	359	77.67
10	165999	0.1593	306	79.67
11	165999	0.1447	239	81.22
12	165999	0.1319	258	82.91
13	165998	0.1206	207	84.26
14	165999	0.1107	191	85.50
15	165999	0.1019	172	86.62
16	165999	0.0939	163	87.69
17	165998	0.0868	128	88.52
18	165999	0.0804	135	89.40
19	165999	0.0746	115	90.15
20	165999	0.0693	106	90.84
21	165998	0.0645	97	91.48
22	165999	0.0600	79	91.99
23	165999	0.0559	86	92.55
24	165999	0.0520	59	92.94
25	165998	0.0483	71	93.40
Women, Period 1 (24 January 2020 to 30 April 2020)				
1	182977	0.7353	4227	36.28
2	182978	0.4011	1752	51.32
3	182978	0.2862	1049	60.32
4	182977	0.2263	728	66.57
5	182978	0.1884	594	71.67
6	182978	0.1611	443	75.47
7	182978	0.1401	331	78.31
8	182977	0.1231	273	80.65
9	182978	0.1090	232	82.65
10	182978	0.0971	219	84.52
11	182978	0.0869	151	85.82
12	182977	0.0781	127	86.91
13	182978	0.0705	140	88.11
14	182978	0.0637	120	89.14
15	182977	0.0577	108	90.07

16	182978	0.0525	77	90.73
17	182978	0.0478	81	91.43
18	182978	0.0437	69	92.02
19	182977	0.0401	63	92.56
20	182978	0.0369	60	93.07
21	182978	0.0340	60	93.59
22	182978	0.0313	53	94.04
23	182977	0.0289	38	94.37
24	182978	0.0267	46	94.76
25	182978	0.0247	32	95.04

Men, Period 2 (1 May 2020 to 28 July 2020)

1	165275	0.8429	2531	38.25
2	165275	0.5263	891	51.72
3	165275	0.3997	551	60.04
4	165275	0.3272	423	66.43
5	165275	0.2781	309	71.10
6	165275	0.2419	267	75.14
7	165275	0.2135	207	78.27
8	165275	0.1904	160	80.69
9	165275	0.1712	117	82.45
10	165275	0.1548	103	84.01
11	165275	0.1407	89	85.36
12	165275	0.1284	79	86.55
13	165275	0.1175	88	87.88
14	165275	0.1079	73	88.98
15	165276	0.0994	49	89.72
16	165275	0.0917	35	90.25
17	165275	0.0848	50	91.01
18	165275	0.0786	38	91.58
19	165275	0.0730	51	92.35
20	165275	0.0678	25	92.73
21	165275	0.0631	24	93.09
22	165275	0.0587	37	93.65
23	165275	0.0547	25	94.03
24	165275	0.0509	32	94.51
25	165275	0.0473	21	94.83

Women, Period 2 (1 May 2020 to 28 July 2020)

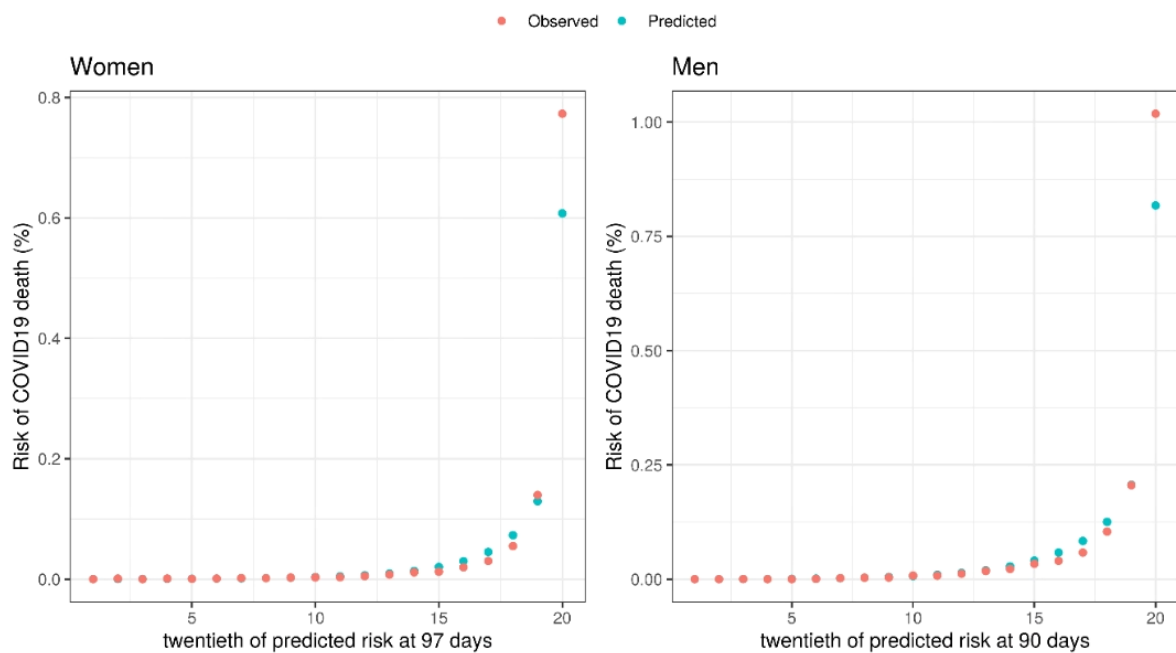
1	182260	0.6629	2793	42.58
2	182261	0.3734	994	57.73
3	182260	0.2710	591	66.74
4	182261	0.2162	367	72.33
5	182261	0.1809	317	77.16
6	182260	0.1552	229	80.66
7	182261	0.1353	152	82.97
8	182261	0.1190	147	85.21
9	182260	0.1055	122	87.07
10	182261	0.0941	83	88.34

11	182261	0.0843	71	89.42
12	182260	0.0758	74	90.55
13	182261	0.0684	56	91.40
14	182261	0.0619	58	92.29
15	182260	0.0562	31	92.76
16	182261	0.0511	40	93.37
17	182261	0.0466	36	93.92
18	182260	0.0427	36	94.47
19	182261	0.0392	21	94.79
20	182261	0.0360	21	95.11
21	182260	0.0332	23	95.46
22	182261	0.0306	22	95.79
23	182260	0.0283	19	96.08
24	182261	0.0262	13	96.28
25	182261	0.0242	18	96.55

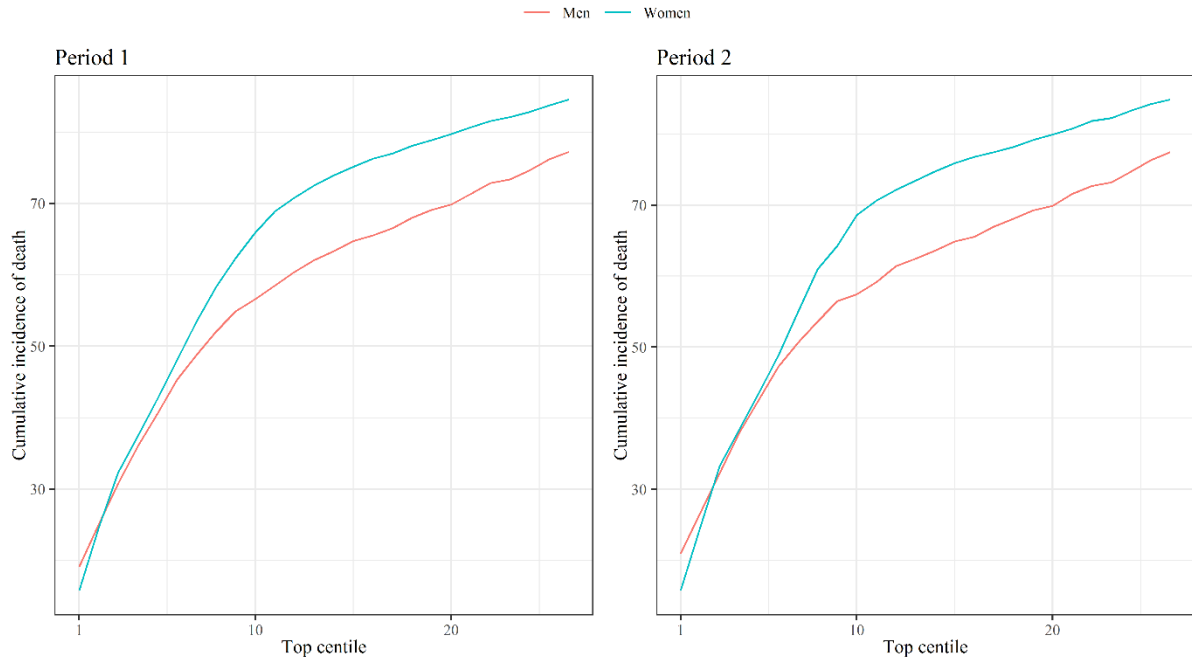
Risk threshold is the centile value giving the cut-off of predicted risk over 90 days for defining each group

Sensitivity is percentage of total deaths over 90 days that occurred within the group of patients above the predicted risk threshold

Supplementary Figure 1: Predicted and observed risk of covid-19 related death in first study period (24 January to 30 April 2020) in patients registered with practices using TPP

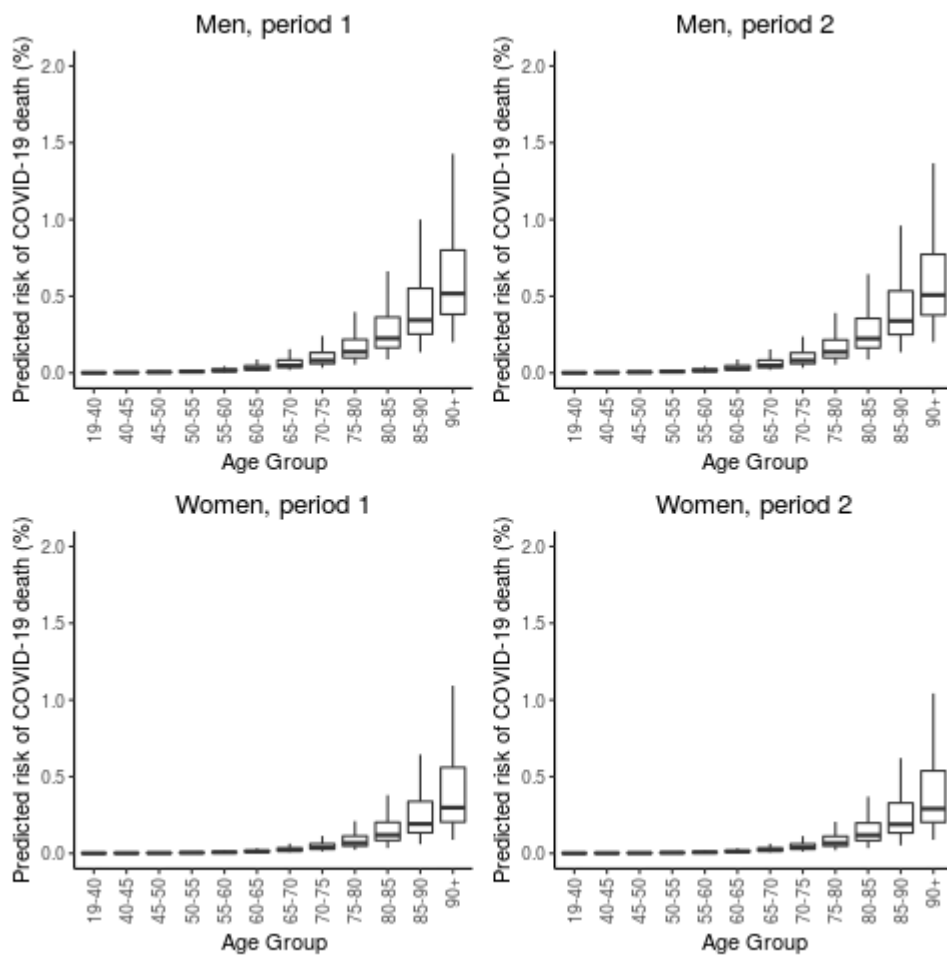


Supplementary Figure 2: Sensitivity for Covid-19 related death in validation cohort for period 1 (24 January 2020 – 30 April 2020) and period 2 (1 May 2020 – 28 July 2020) based on relative risks



Centiles based on predicted relative risks compared with someone of the same age/sex with no risk factors. Sensitivity is percentage of total deaths in the period that occurred within the group of patients above the predicted risk threshold.

Supplementary Figure 3: Distribution of predicted risk of COVID-19 death by age group and sex for period 1 (24 January 2020 – 30 April 2020) and period 2 (1 May 2020 – 28 July 2020)



The median is shown as the bold line within the hinge, which represents the interquartile range (IQR). The upper whisker extends from the hinge to the largest value no further than one and a half times the IQR from the hinge.