Impact of baseline cases of cough and fever on UK COVID-19 diagnostic testing rates: estimates from the Bug Watch community cohort study

Supplementary Material

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S1. Study population

Out of a total of 19,741 adults who were invited to join the study, 1,063 (5%) were initially recruited. An additional 179 individuals (21 adults, 158 children) who were living in these households were then recruited, resulting in a total of 1,242 people registered for the study. Weekly surveys were completed relatively consistently across the duration of the study [8] and 72% (782/1,084) of adults completed 75% or more surveys. Consequently, a total of 873 participants were included in the analysis (782 adults and 91 children that they had registered), providing a total follow-up time of 23,111 person-weeks.

The study participants were 60.5% (528/873) female and older than the general population with participants in the following age groups: 56-70, >70 and 36-55 years, comprising 43.2% (377/873), 19.9% (174/873) and 19.5% (170/873) of the cohort, respectively. Participants in age groups of ≤5 years, 6-16 years and 17-35 years represented 3.0% (26/873), 7.5% (65/873) and 6.5% (57/873) of the cohort, respectively. Full details of the baseline characteristics of the study cohort and excluded participants and the representativeness of the study cohort with respect to the general population of England have been described in more detail previously [8].

S2. Age-specific incidence rates of cough or fever

Monthly age-specific incidence rates of cough or fever per 100,000-person-week in England in Figure S2.1 show that all age groups followed a seasonal trend. Children (Figure S2.1a - note the different y-axis scale to Figures S2.1b-d) experienced particularly high monthly incidence rates relative to the other age groups in November, December and February of 6,211 (95%CI 2,857 - 13,499), 7,560 (95%CI 4,732 - 12,078) and 8,084 (95%CI 4,715 - 13,858) per 100,000-person-week, respectively. Higher uncertainty in the estimates for this age group reflects lower participation rates relative to the other age groups. Monthly incidences in the 17-55 and 56-70 years age groups were similar in magnitude throughout the year and were generally slightly higher than those for the >70 years age group.

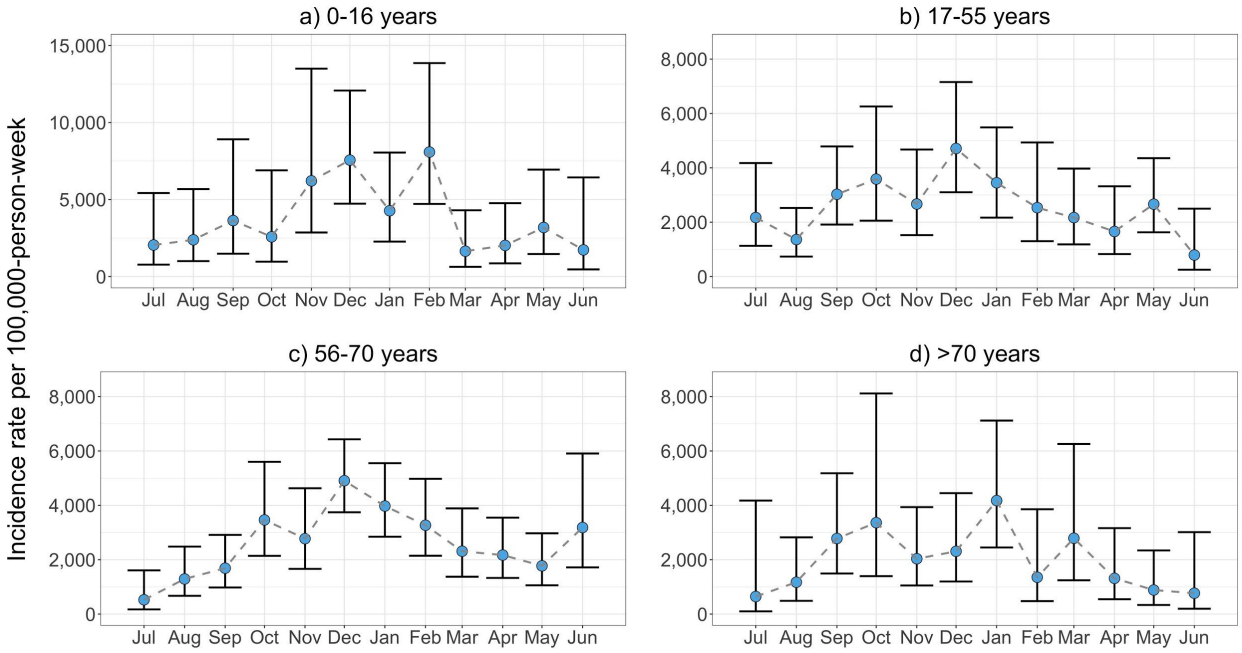


Figure S2.1 Monthly age-specific incidence rates of cough or fever per 100,000-person-week in England with 95% confidence intervals. Weighted to the mid-2019 population structure of England by sex and region. Note that panel a) has a different y-axis scale to panels b) - d).

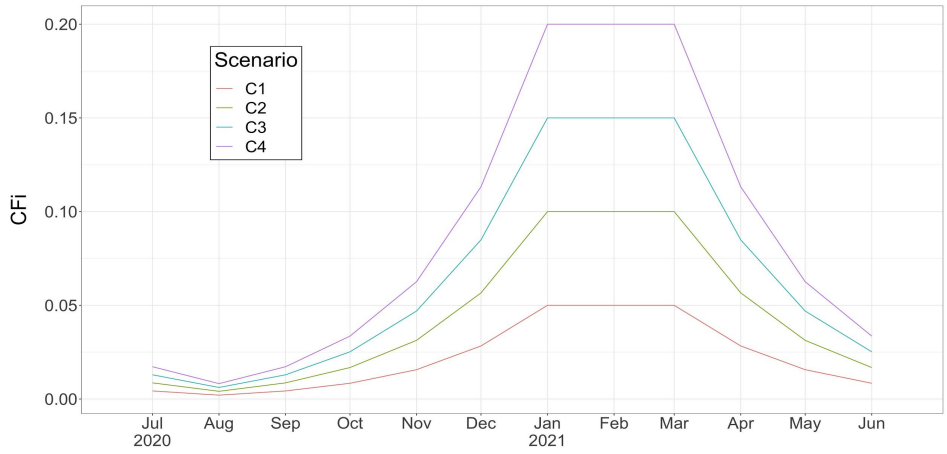
S3. COVID-19 incidences for scenarios C1 to C4

COVID-19 incidences were included in the testing demand calculations as a single average daily incidence estimate for each month during the period July 2020 - June 2021 as shown in Figure 4 in the main article. An exponential rise and decay were chosen for the epidemic, with the highest incidences in January and February 2021, based on the predictions from Academy of Medical Sciences' report "Preparing for a Challenging Winter 2020/21". To create these second wave COVID-19 scenarios, COVID-19 incidence, cov_i, was calculated as a fraction of the baseline cough or fever incidence $base_i$ in each month, i (where $i = 1$denotes July 2020 and $i = 12$ denotes June 2021), using a time-varying COVID-19 Factor, CF_i, as follows:

$$cov_i = CF_i \times base_i$$

$$CF_i = \frac{CF_{max,C} exp(k_i^{\alpha})}{exp(6^{\alpha})}$$

Where $CF_{max,C}$ is the maximum value of CF_i (in the peak months of January - March 2021) for each second wave scenario $C = C1, C2, C3, C4$, equal to 0.05, 0.10, 0.15 and 0.20, respectively. The shape of the epidemic curve is determined by a shape parameter, $\alpha = 0.8$. Values of CF_i are shown for each scenario C1 to C4 in Figure S4.1 and values of $k_i$were used to create higher and lower incidence periods; these are shown for each month in Table S4.1.



S3.1 CF_i values for each month of the study period

Table S3.1 k_i values used for each month of the study period to create the epidemic shape

Month (i)	July 2020	Aug	Sep	Oct	Nov	Dec	Jan 2021	Feb	Mar	Apr	May	Jun
k_i	2	1	2	3	4	5	6	6	6	5	4	3

S4. Full exploration of proportion requesting test values for each scenario: C1, C3 and C4

In Figures S4.1 – S4.2 the total demand during the winter months is marginally higher in the more severe scenarios C3 and C4. However, even in the highest transmission scenario, demand due to symptomatic COVID-19 cases is low relative to the demand from baseline cough or fever cases. Consequently, while COVID-19 cases exacerbate the problem during the winter months, there is little overall change in the number of months which are at risk of running a testing deficit across these scenarios. For this reason, only scenario C2 was included in the main text.

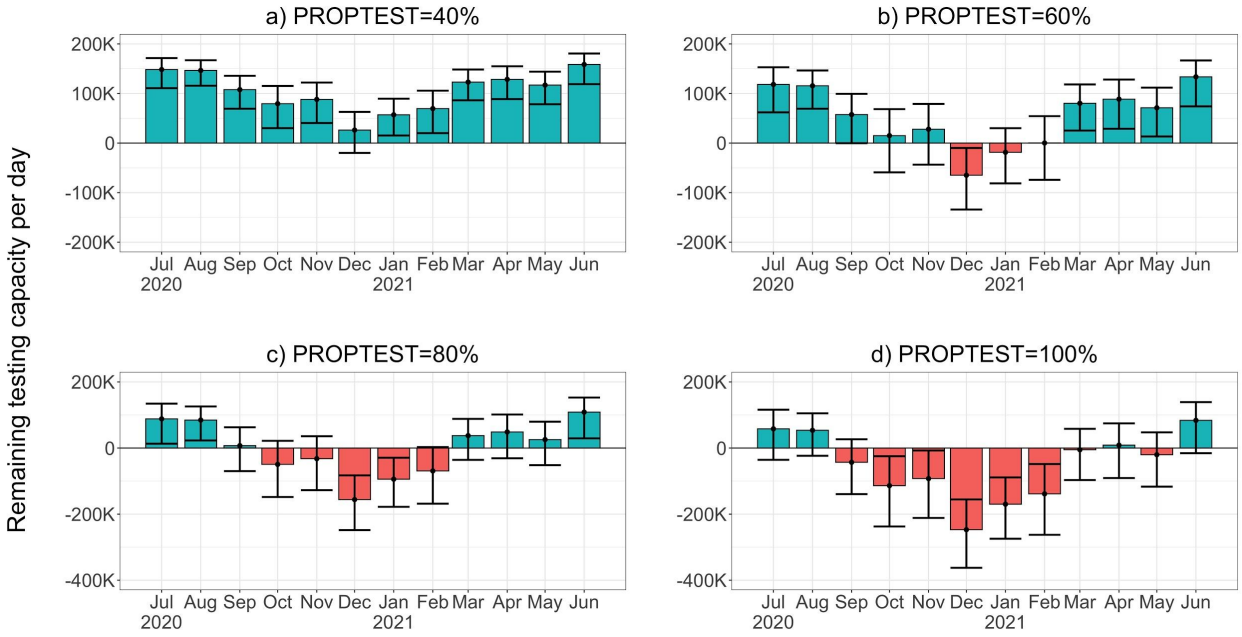


Figure S4.1 Remaining UK Pillar 1 and 2 testing capacity (thousands of tests) per day after testing baseline (non-COVID-19) cases of cough or fever and symptomatic COVID-19 cases in the UK each day for scenario C1. Panels a) to d) show results for four values of the proportion of cases requesting tests (PROPTEST). Blue and red bars indicate that testing demand is within or in excess of current capacity, respectively. Note that panel a) has a different y-axis scale to panels b) - d).

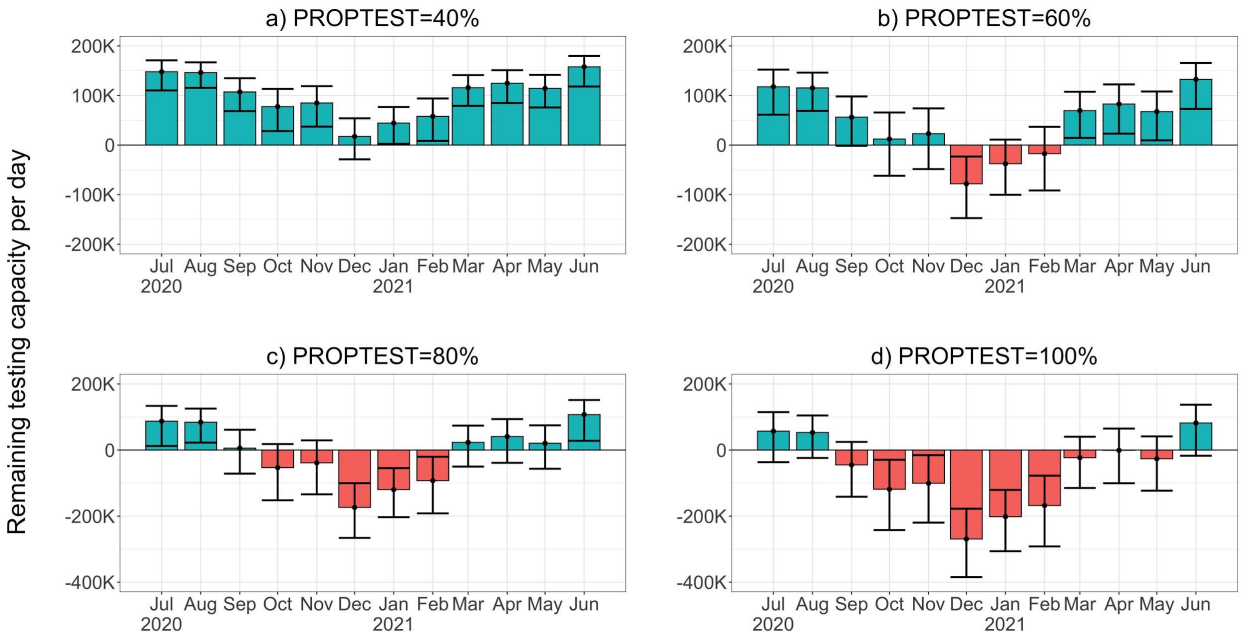


Figure S4.2 Remaining UK Pillar 1 and 2 testing capacity (thousands of tests) per day after testing baseline (non-COVID-19) cases of cough or fever and symptomatic COVID-19 cases in the UK each day for scenario C3.

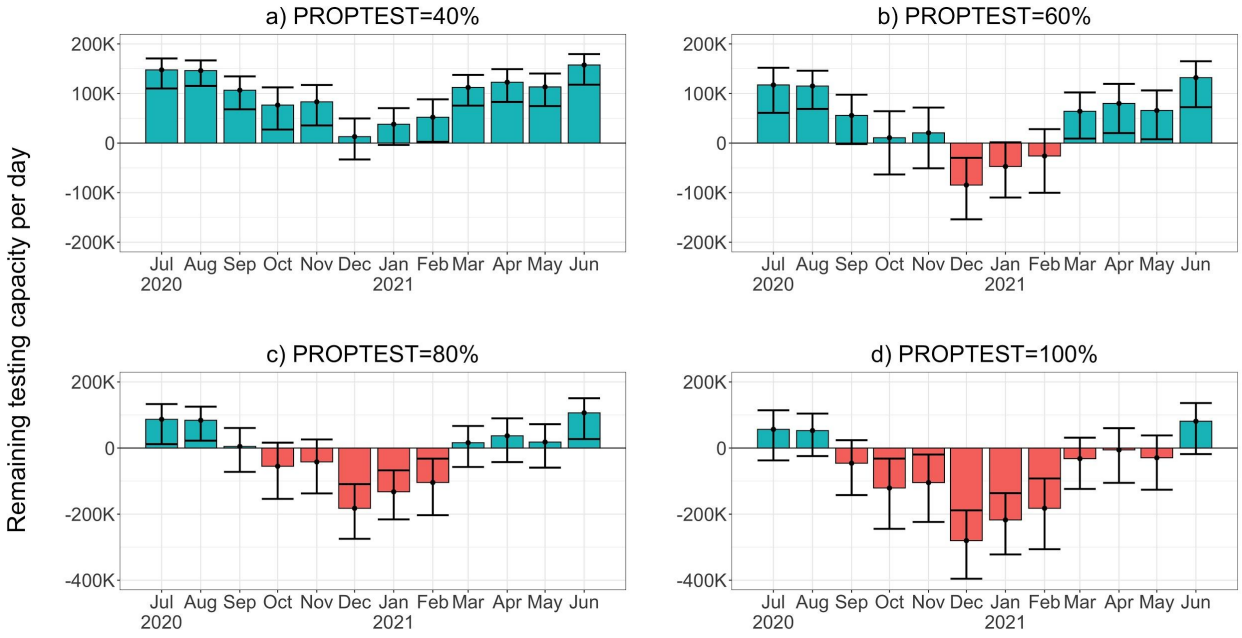


Figure S4.3 Remaining UK Pillar 1 and 2 testing capacity (thousands of tests) per day after testing baseline (non-COVID-19) cases of cough or fever and symptomatic COVID-19 cases in the UK each day for scenario C4.

S5. Full exploration of scenarios C1, C3 and C4 for each proportion requesting test value: 40%, 60%, 100%

As was mentioned in the main text, in Figures S5.1-S5.3 the contribution of symptomatic COVID-19 cases to demand relative to baseline cough and fever cases remains the same for all values of the proportion requesting tests. However, as expected, higher values of the proportion requesting tests results in significantly higher total demand across the next year (note that the y-axis in Figures S5.1-S5.3 are different).

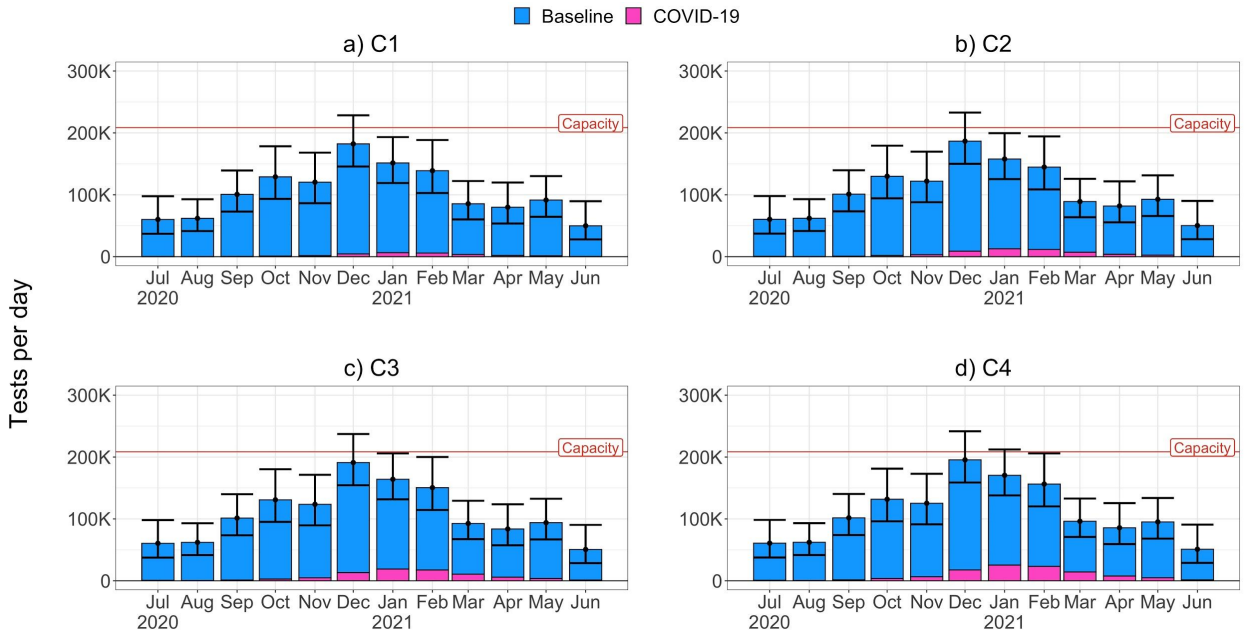


Figure S5.1 Predicted daily testing demand (thousands of tests) due to baseline cough or fever cases (blue) and symptomatic COVID-19 cases (pink) in the UK, assuming that 40% of cases request tests. Panels a) to d) show results for scenarios C1 to C4. Current daily UK Pillar 1 and 2 testing capacity is marked with a red line.

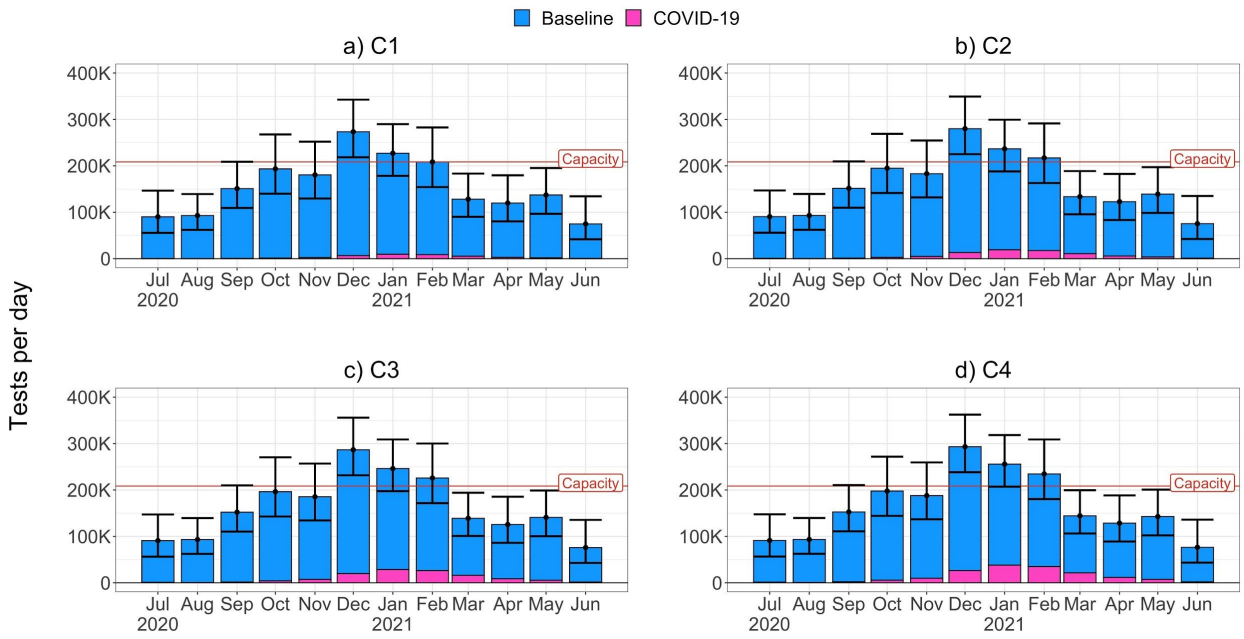


Figure S5.2 Predicted daily testing demand (thousands of tests) due to baseline cough or fever cases (blue) and symptomatic COVID-19 cases (pink) in the UK, assuming that 60% of cases request tests. Panels a) to d) show results for scenarios C1 to C4. Current daily UK Pillar 1 and 2 testing capacity is marked with a red line.

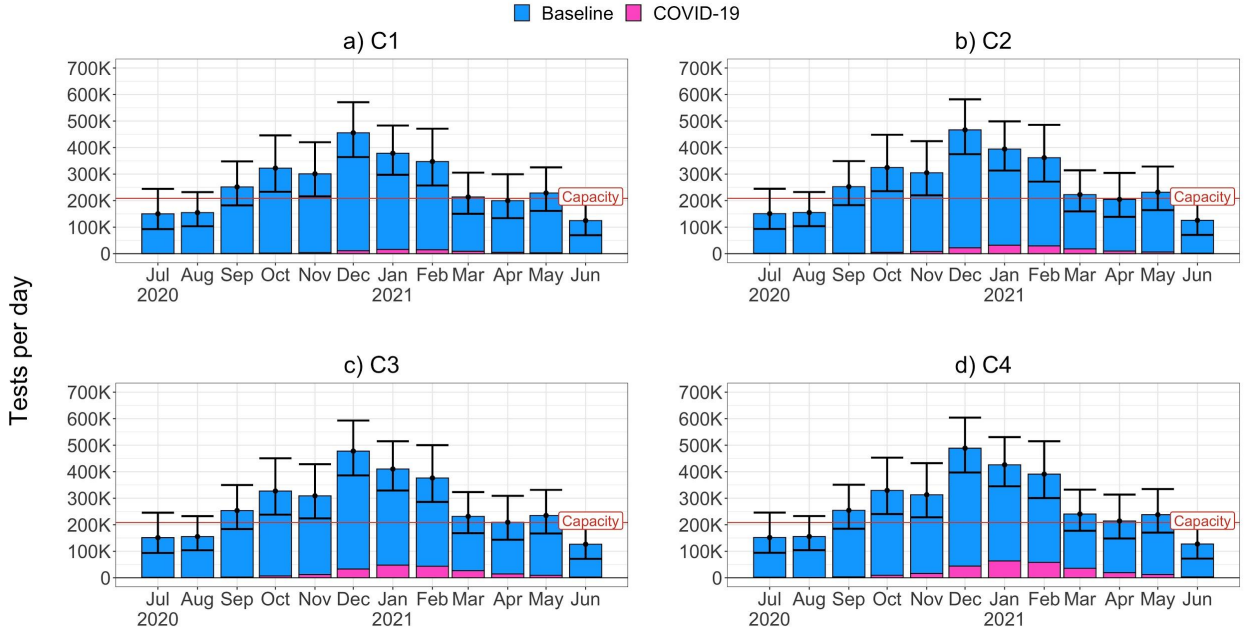


Figure S5.3 Predicted daily testing demand (thousands of tests) due to baseline cough or fever cases (blue) and symptomatic COVID-19 cases (pink) in the UK, assuming that 100% of cases request tests. Panels a) to d) show results for scenarios C1 to C4. Current daily UK Pillar 1 and 2 testing capacity is marked with a red line.

S6. Estimated cough incidence rates in England

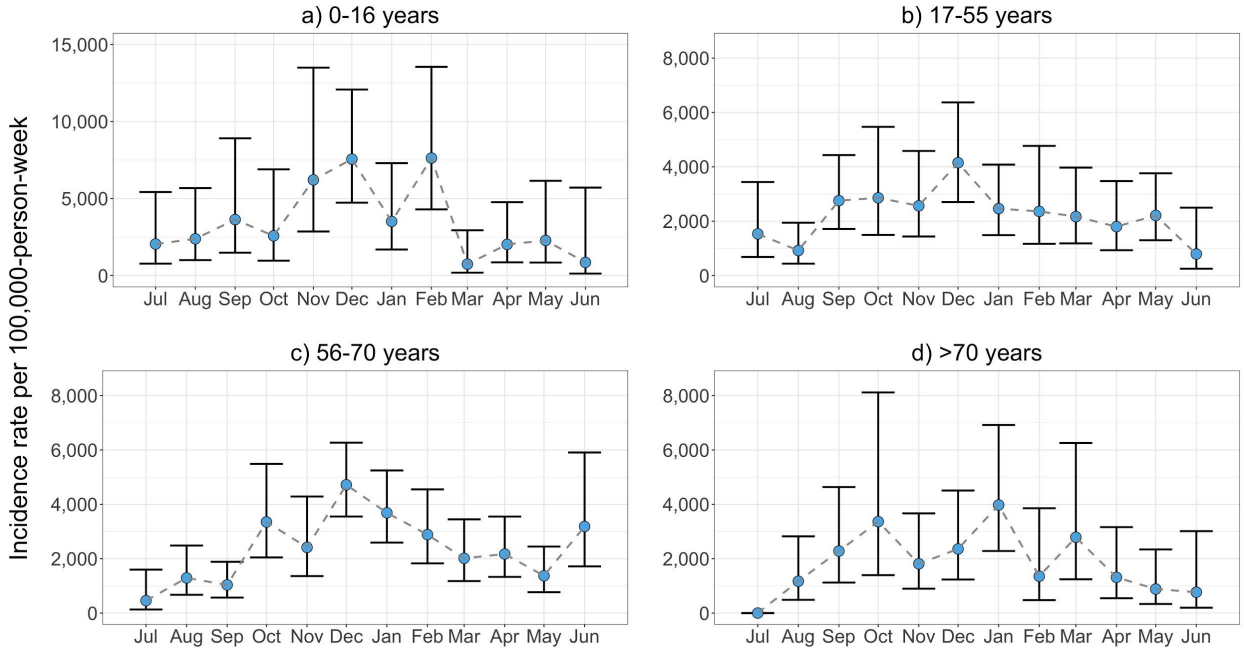


Figure S6.1 Monthly age-specific incidence rates of cough per 100,000-person-week in England with 95% confidence intervals. Weighted to the mid-2019 population structure of England by sex and region.

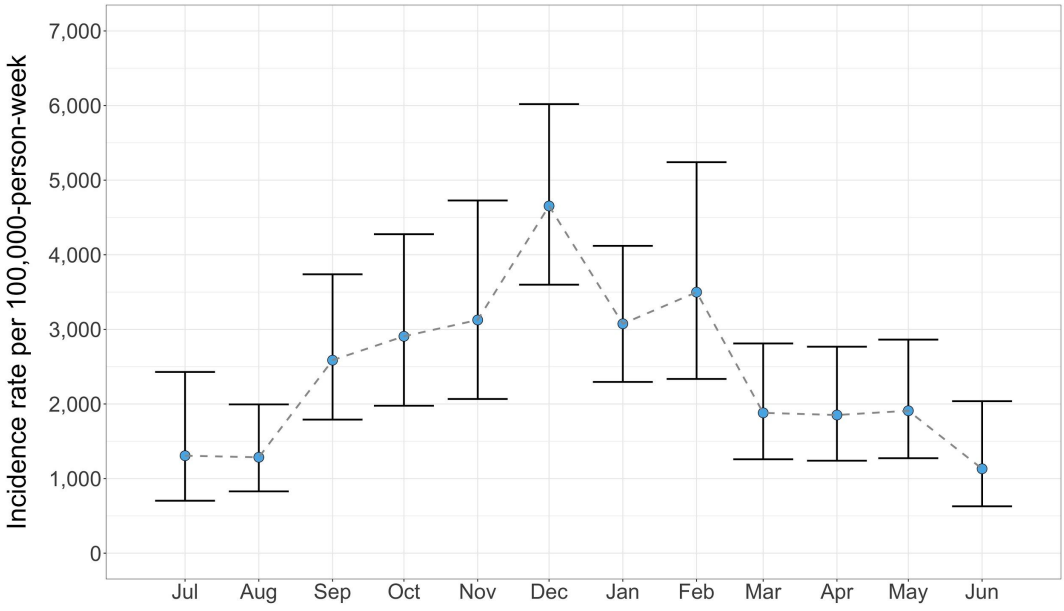


Figure S6.2 Monthly adjusted incidence rates of cough per 100,000-person-week in England with 95% confidence intervals. Weighted to the mid-2019 population structure of England by age, sex and region.

S7. Estimated fever incidence in England

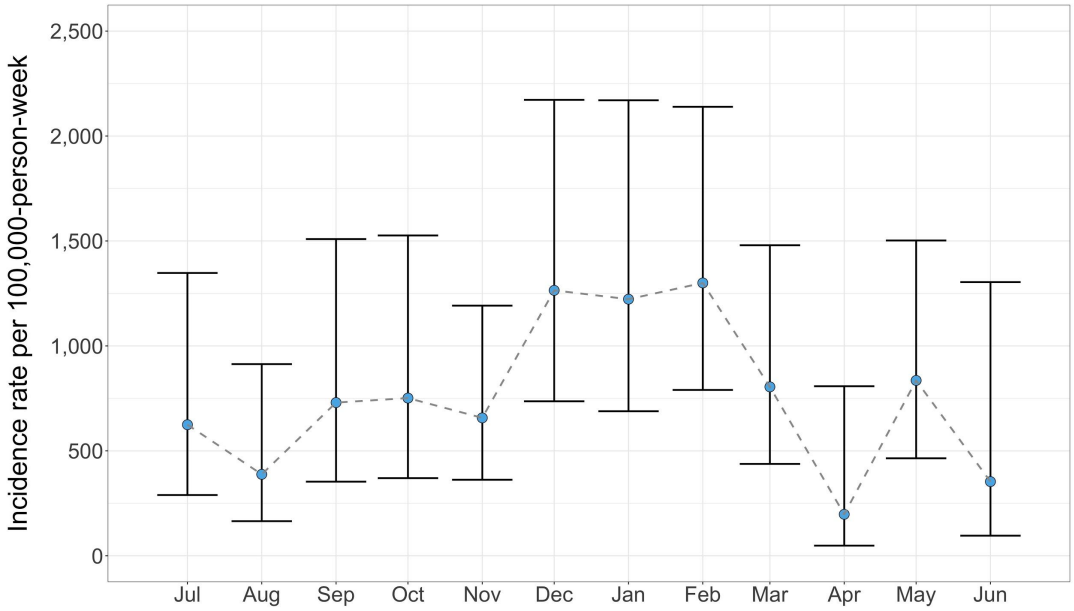


Figure S7.1 Monthly adjusted incidence rates of fever per 100,000-person-week in England with 95% confidence intervals. Weighted to the mid-2019 population structure of England by age, sex and region.