

# UK Covid-19 LAD/Age model

## Situation report 2020-03-20

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### Current best estimates

- Estimates are based on case data reported by gov.uk<sup>1</sup> up to and including 2020-03-15.
- There are some anomalies in the data for [2020-03-16, 2020-3-19] which we need to discuss -- this may be in line with Nick Gent's comment that the RCGP swabbing data appears to be incomplete in the last few days.
- We estimate that on 2020-03-20:
  - Predicted numbers of infected (E+I): 95,000 (67,000, 128,000)
  - Predicted numbers of removed (R): 31,000 (29,000, 34,000)<sup>2</sup>
  - Incidence: 0.51 per 10,000 per day (0.48, 0.56)
  - R<sub>0</sub>: 4.4 (3.5, 5.4)
  - Doubling time: 4.4 days (4.3, 4.6)
  - Infectious period: 9.5 days (6.9, 12.5)

Figure 1 shows the current prediction for the total number of infected people over time, assuming school closures as from 2020-03-23. Figure 2 indicates our current model fit against gov.uk reported cases -- it is clear that a degree of "catch up" in surveillance is currently going on, **highlighting the requirement for increased surveillance resource quickly.**

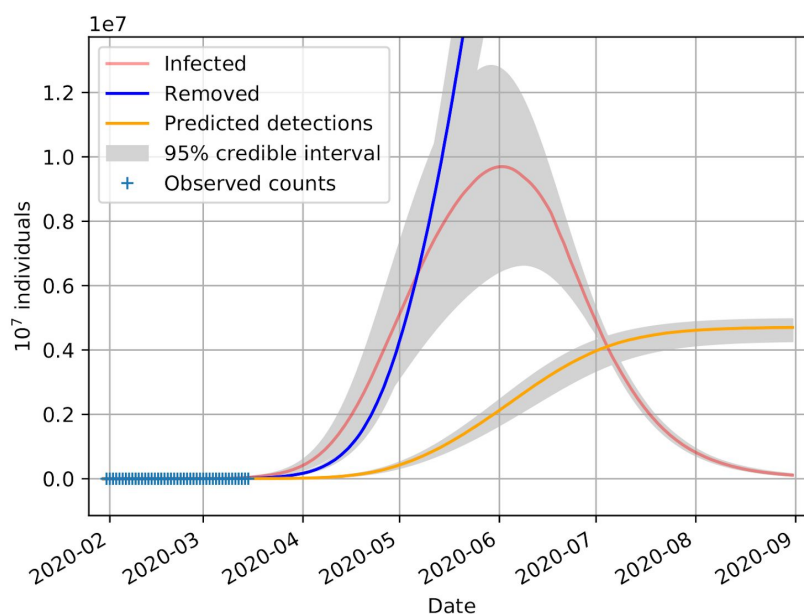


Figure 1: Predicted number of infections forward from 2020-03-15

<sup>1</sup> <https://www.gov.uk/government/publications/covid-19-track-coronavirus-cases>

<sup>2</sup> in our model these equate to individuals with symptoms and are self-isolating or seeking care (and do not then contribute to transmission)

# Assumptions

- Deterministic SEIR dynamics, with an assumed 4 day mean latent period (i.e. sojourn in E class)
- Epidemic starts on 2020-02-02
- “Background” importation infectious pressure until 2020-03-01
- Meta-populations are age/UTLA combinations in England, with demographic data (age-stratified population size) taken from ONS UK mid-year estimates 2018-2019 at the UTLA level.
- Ages mix within using Polymod
  - Normal Polymod up to and including 2020-03-22
  - “Weekend” Polymod thereafter
- UTLAs are connected via Census 2011 commuting data, MSOAs mapped onto UTLAs.
- Given between-LAD connectivity, “commuting” contacts are assumed to occur at  $\bar{K}/3$  the rate of within-LAD contacts. This accounts for the average contact rate between all age groups and for the 8h working day out of a total of 24h.
- Daily new cases are modelled as a Poisson random variable with mean the daily number of Removals (I->R) given by the model.
- “Background” importation rate, baseline infection rate, infectious period (I->R) estimated by MCMC.
- Code available: <http://fhm-chicas-code.lancs.ac.uk/jewell/covid19uk>

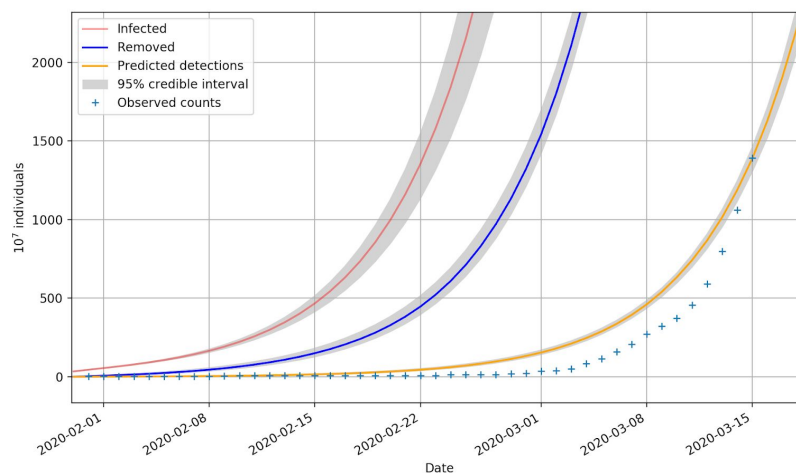


Figure 2: Model fit -- current SIR dynamics do not currently capture gov.uk-provided data satisfactorily. This may be due to reporting delays by PHE as much as mis-capture of the underlying epidemic dynamics.