**S1 Table.** Definition of the different parameters and their priors for Ile-de-France region, Ireland and four other French regions: Provence Alpes Côte d’Azur (PACA), Occitanie (OC), Nouvelle-Aquitaine (NA), Auvergne Rhône Alpes (ARA). The priors have been chosen based on current literature. U stands for uniform distribution and tN for truncated normal distribution (tN[mean, std, limit inf, limit sup]).

| Parameters | Definitions | Prior or constant value | Prior or constant value | Prior or constant value |
|------------|-------------|------------------------|------------------------|------------------------|
|            |             | Ile de France *         | Ile de France **        | Ireland                |
| $I_1(0)$   | Initial condition | U[10,1500]              | U[10,1500]              | U[5,100]               |
| $S(0)$     | Initial condition | N=12278000              | N=12278000              | N=5176000              |
| $E_1(0), E_2(0), I_2(0), A_1(0), A_2(0)$ | Initial conditions | Use of steady-state conditions *** | Use of steady-state conditions *** | Use of steady-state conditions *** |
| $H_1(0), H_2(0), ICU(0), D(0), G(0), R(0)$ | Initials conditions | 0                      | 0                      | 0                      |
| $\beta(0)$ | Initial condition of the transmission rate | 0.85                    | 0.85                    | 0.70                   |
| $\nu$      | Volatility of the Brownian process | U[0.02,0.15]            | U[0.02,0.15]            | U[0.05,0.15]           |
| $1/\sigma$ | average duration of the incubation period | tN[4,0.1,3,5] (Di Domenico et al, 2020) | tN[4,0.1,3,5] (Di Domenico et al, 2020) | tN[4,0.1,3,5] (Di Domenico et al, 2020) |
| $1/\gamma$ | average duration of the infectious period | tN[6,0.2,4.5,7.5] (eg Ferguson et al, 2020) | tN[6,0.2,4.5,7.5] (eg Ferguson et al, 2020) | tN[6,0.2,4.5,7.5] (eg Ferguson et al, 2020) |
| $1/\kappa$ | average hospitalization period | U[10,20]                | U[10,20]                | U[8,20]                |
| $1/\delta$ | average time spent in ICU | U[10,20]                | U[10,20]                | U[8,20]                |
| $\tau_A$  | fraction of asymptomatics | U[0.30,0.70]            | U[0.30,0.70]            | U[0.30,0.70]           |
| $\tau_H$  | fraction of hospitalization | U[0.02,0.10]            | U[0.02,0.10]            | U[0.02,0.10]           |
| $\tau_I$  | fraction of ICU admission | U[0.05,0.15]            | U[0.05,0.15]            | U[0.025,0.15]          |
| $\tau_D$  | death rate | U[0.10,0.80]            | U[0.10,0.80]            | U[0.10,0.60]           |
| $q_1$      | reduction in transmissibility | 1.5* q1; but ≤1        | 1.5* q1; but ≤1        | 1.5* q1; but ≤1       |
| $q_2$      | reduction in transmissibility | 0.55 (Li et al, 2020)  | 0.55 (Li et al, 2020)  | 0.55 (Li et al, 2020) |
| $q_3$      | reduction in ICU admission fraction | 0.05                    | 0.05                    | 0.10                   |
| $q_D$      | reduction in death rate | 0.10                    | 0.10                    | 0.20                   |
| $\rho_I$  | reporting rate for symptomatic infectious | U[0.01, 0.10]           | U[0.01, 0.10]           | U[0.02, 0.15]          |
| $\rho_H$  | reporting rate for hospitalized people | U[0.95,1]               | U[0.95,1]               | U[0.95,1]              |
| $\rho_{ICU}$ | reporting rate for ICU admission | 0.96                    | 0.96                    | 0.96                   |
| $\rho_G$  | reporting rate for hospital discharge | 0.96                    | 0.96                    | 0.96                   |
| $\rho_D$  | reporting rate for death | 0.98                    | 0.98                    | 0.98                   |

* using hospital discharge data and ** not using hospital discharge data
*** steady-state conditions are defined by: $\frac{dE_1}{dt} = \frac{dE_2}{dt} = \frac{dI_1}{dt} = \frac{dI_2}{dt} = \frac{dA_1}{dt} = \frac{dA_2}{dt} = 0$
### S1 Table. (continued)

| Parameters | Prior or constant value | Prior or constant value | Prior or constant value | Prior or constant value |
|------------|-------------------------|-------------------------|-------------------------|-------------------------|
|            | PACA                    | OC                      | NA                      | ARA                     |
| $I_f(0)$   | U[10,500]               | U[10,300]               | U[10,200]               | U[10,1000]              |
| $S(0)$     | N=5055000               | N=5845000               | N=5957000               | N=5176000               |
| $E_i(0), E_s(0), I_2(0), A_1(0), A_2(0)$ | Use of steady-state conditions *** | Use of steady-state conditions *** | Use of steady-state conditions *** | Use of steady-state conditions *** |
| $H_i(0), H_s(0), ICU(0), D(0), G(0), R(0)$ | 0                       | 0                       | 0                       | 0                       |
| $\beta(0)$ | 0.70                    | 0.85                    | 0.70                    | 0.70                    |
| $\nu$      | U[0.02,0.15]            | U[0.02,0.15]            | U[0.02,0.15]            | U[0.02,0.15]            |
| $1/\alpha$ | tN[4,0.1,3,5]           | tN[4,0.1,3,5]           | tN[4,0.1,3,5]           | tN[4,0.1,3,5]           |
| (Di Domenico et al, 2020) |                       | (Di Domenico et al, 2020) | (Di Domenico et al, 2020) | (Di Domenico et al, 2020) |
| $1/\gamma$ | tN[6,0.2,4,5,7.5]       | tN[6,0.2,4,5,7.5]       | tN[6,0.2,4,5,7.5]       | tN[6,0.2,4,5,7.5]       |
| (eg Ferguson et al, 2020) |                       | (eg Ferguson et al, 2020) | (eg Ferguson et al, 2020) | (eg Ferguson et al, 2020) |
| $1/\kappa$ | U[10,20]                | U[8,18]                 | U[8,18]                 | U[10,20]                |
| $1/\delta$ | U[10,20]                | U[10,20]                | U[14,24]                | U[12,22]                |
| $\tau_A$  | U[0.30,0.70]            | U[0.30,0.70]            | U[0.30,0.70]            | U[0.30,0.70]            |
| $\tau_H$  | U[0.02,0.15]            | U[0.02,0.10]            | U[0.02,0.10]            | U[0.02,0.10]            |
| $\tau_I$  | U[0.05,0.15]            | U[0.05,0.20]            | U[0.05,0.15]            | U[0.05,0.15]            |
| $\tau_D$  | U[0.10,0.60]            | U[0.10,0.60]            | U[0.10,0.60]            | U[0.10,0.80]            |
| $q_1$     | 1.5*q_2 but≤1           | 1.5*q_2 but≤1           | 1.5*q_2 but≤1           | 1.5*q_2 but≤1           |
| $q_2$     | 0.55                    | 0.55                    | 0.55                    | 0.55                    |
|           | (Li et al, 2020)        | (Li et al, 2020)        | (Li et al, 2020)        | (Li et al, 2020)        |
| $q_3$     | 0.05                    | 0.05                    | 0.05                    | 0.05                    |
| $q_D$     | 0.10                    | 0.10                    | 0.10                    | 0.10                    |
| $\rho_1$  | U[0.02, 0.15]           | U[0.02, 0.15]           | U[0.02, 0.15]           | U[0.01, 0.10]           |
| $\rho_H$  | U[0.95,1]               | U[0.95,1]               | U[0.95,1]               | U[0.95,1]               |
| $\rho_{ICU}$ | 0.96                 | 0.96                    | 0.96                    | 0.96                    |
| $\rho_G$  | 0.96                    | 0.96                    | 0.96                    | 0.96                    |
| $\rho_D$  | 0.98                    | 0.98                    | 0.98                    | 0.98                    |