

## S2 Appendix. Deterministic model representation.

The deterministic skeleton of our model is defined mathematically by the below set of coupled differential equations. In order to study the cloud of likely stochastic outcomes, we discretized time in daily time steps and implemented the multi-compartmental chain-binomial version of the model.

$$\dot{S}_{\text{susceptible}} = \frac{-d\beta S(I_M + I_S + W_{I_M} + W_{I_S})}{N - H - \sum T_i} + \frac{-d\rho\beta S(A + P_M + P_S + W_A + W_{P_M} + W_{P_S})}{N - H - \sum T_i} \quad (1)$$

transmission, reported symptoms                      transmission, unreported symptoms

$$\dot{E}_{\text{exposed}} = \frac{d\beta S(I_M + I_S + W_{I_M} + W_{I_S})}{N - H - \sum T_i} + \frac{d\rho\beta S(A + P_M + P_S + W_A + W_{P_M} + W_{P_S})}{N - H - \sum T_i} - \sigma E_{\text{become infectious}} \quad (2)$$

transmission, reported symptoms                      transmission, unreported symptoms

$$\dot{P}_M^{\text{presymptomatic eventually mild}} = (1-p)(1-q)\sigma E_{\text{become infectious}} - \frac{\delta P_M}{\text{symptoms develop, report}} - \frac{\omega P_M}{\text{receive test await results to isolate}} \quad (3)$$

$$\dot{P}_S^{\text{presymptomatic eventually severe}} = (1-p)q\sigma E_{\text{become infectious}} - \frac{\delta P_S}{\text{symptoms develop, report}} - \frac{\omega P_S}{\text{receive test await results to isolate}} \quad (4)$$

$$\dot{A}_{\text{asymptomatic}} = p\sigma E_{\text{become infectious}} - \gamma_A A_{\text{recover}} - \frac{\omega A}{\text{receive test await results to isolate}} \quad (5)$$

$$\dot{I}_M^{\text{mild symptoms}} = \frac{\delta P_M}{\text{symptoms develop, report}} - \gamma_M I_M_{\text{recover}} - \frac{\omega I_M}{\text{receive test isolate immediately}} \quad (6)$$

$$\dot{I}_S^{\text{severe symptoms}} = \frac{\delta P_S}{\text{symptoms develop, report}} - \eta I_S_{\text{hospitalized}} - \frac{\omega I_S}{\text{receive test isolate immediately}} \quad (7)$$

$$\dot{W}_{P_M}^{\text{awaiting results presymptomatic, mild}} = \frac{\omega P_M}{\text{receive test await results to isolate}} - \frac{\tau W_{P_M}}{\text{recieve results enter isolation}} - \frac{\delta W_{P_M}}{\text{symptoms before results}} \quad (8)$$

$$\dot{W}_{P_S}^{\text{awaiting results presymptomatic, severe}} = \frac{\omega P_S}{\text{receive test await results to isolate}} - \frac{\tau W_{P_S}}{\text{recieve results enter isolation}} - \frac{\delta W_{P_S}}{\text{symptoms before results}} \quad (9)$$

$$\dot{W}_A^{\text{awaiting results asymptomatic}} = \frac{\omega A}{\text{receive test await results to isolate}} - \frac{\tau W_A}{\text{recieve results enter isolation}} - \frac{\gamma_A W_A}{\text{recover before results}} \quad (10)$$

$$\dot{W}_{I_M}^{\text{awaiting results mild symptoms reported}} = \frac{\delta W_{P_M}}{\text{symptoms before results}} - \frac{\gamma_M W_{I_M}}{\text{recover before results}} - \frac{\tau W_{I_M}}{\text{recieve results enter isolation}} \quad (11)$$

$$\dot{W}_{I_S}^{\text{awaiting results severe symptoms reported}} = \frac{\delta W_{P_S}}{\text{symptoms before results}} - \frac{\eta W_{I_S}}{\text{hospitalized before results}} - \frac{\tau W_{I_S}}{\text{recieve results enter isolation}} \quad (12)$$

$$\dot{T}_{P_M}^{\text{isolated mild presymptomatic}} = \frac{\tau W_{P_M}}{\text{recieve results enter isolation}} - \frac{\delta T_{P_M}}{\text{symptoms after isolation}} \quad (13)$$

$$\dot{T}_{P_S}^{\text{isolated severe presymptomatic}} = \frac{\tau W_{P_S}}{\text{recieve results enter isolation}} - \frac{\delta T_{P_S}}{\text{symptoms after isolation}} \quad (14)$$

$$\dot{T}_A^{\text{isolated asymptomatic}} = \frac{\tau W_A}{\text{recieve results enter isolation}} - \gamma_A T_A_{\text{recover}} \quad (15)$$

$$\dot{T}_{I_M}^{\text{isolated mild symptomatic}} = \frac{\omega I_M}{\text{receive test isolate immediately}} + \frac{\tau W_{I_M}}{\text{recieve results enter isolation}} + \frac{\delta T_{P_M}}{\text{symptoms after isolation}} - \gamma_M T_{I_M}_{\text{recover}} \quad (16)$$

$$\dot{T}_{I_S}^{\text{positive, isolated severe symptomatic}} = \frac{\omega I_S}{\text{receive test isolate immediately}} + \frac{\tau W_{I_S}}{\text{recieve results enter isolation}} + \frac{\delta T_{P_S}}{\text{symptoms after isolation}} - \eta T_{I_S}_{\text{hospitalized}} \quad (17)$$

$$\dot{H}_{\text{hospitalized}} = \eta(I_S + W_{I_S} + T_{I_S})_{\text{become hospitalized}} - \alpha H_{\text{death}} - \gamma_S H_{\text{recover}} \quad (18)$$

$$\begin{array}{c} \dot{R} \\ \text{recovered} \end{array} = \begin{array}{c} \gamma_M(I_M + W_{I_M} + T_{I_M}) \\ \text{mild symptom recovery} \end{array} + \begin{array}{c} \gamma_A(A + W_A + T_A) \\ \text{asymptomatic recovery} \end{array} + \begin{array}{c} \gamma_S H \\ \text{hospitalized recovery} \end{array} \quad (19)$$

$$\begin{array}{c} \dot{N} \\ \text{total population} \end{array} = - \begin{array}{c} \alpha H \\ \text{death} \end{array} \quad (20)$$

$$(21)$$

with parameters defined in Table 1. When assuming that all individuals, including those with reported symptoms, wait until receiving a positive test result to isolate, Equations 11, 12, 16, and 17 become

$$\begin{array}{c} \dot{W}_{I_M} \\ \text{awaiting results} \\ \text{mild symptoms reported} \end{array} = \begin{array}{c} \omega_{I_M} \\ \text{receive test} \\ \text{await results to isolate} \end{array} + \begin{array}{c} \delta W_{P_M} \\ \text{symptoms} \\ \text{before results} \end{array} - \begin{array}{c} \gamma_M W_{I_M} \\ \text{recover} \\ \text{before results} \end{array} - \begin{array}{c} \tau W_{I_M} \\ \text{recieve results} \\ \text{enter isolation} \end{array} \quad (22)$$

$$\begin{array}{c} \dot{W}_{I_S} \\ \text{awaiting results} \\ \text{severe symptoms reported} \end{array} = \begin{array}{c} \omega_{I_S} \\ \text{receive test} \\ \text{await results to isolate} \end{array} + \begin{array}{c} \delta W_{P_S} \\ \text{symptoms} \\ \text{before results} \end{array} - \begin{array}{c} \eta W_{I_S} \\ \text{hospitalized} \\ \text{before results} \end{array} - \begin{array}{c} \tau W_{I_S} \\ \text{recieve results} \\ \text{enter isolation} \end{array} \quad (23)$$

$$\begin{array}{c} \dot{T}_{I_M} \\ \text{isolated} \\ \text{mild symptomatic} \end{array} = \begin{array}{c} \tau W_{I_M} \\ \text{recieve results} \\ \text{enter isolation} \end{array} + \begin{array}{c} \delta T_{P_M} \\ \text{symptoms} \\ \text{after isolation} \end{array} - \begin{array}{c} \gamma_M T_{I_M} \\ \text{recover} \end{array} \quad (24)$$

$$\begin{array}{c} \dot{T}_{I_S} \\ \text{positive, isolated} \\ \text{severe symptomatic} \end{array} = \begin{array}{c} \tau W_{I_S} \\ \text{recieve results} \\ \text{enter isolation} \end{array} + \begin{array}{c} \delta T_{P_S} \\ \text{symptoms} \\ \text{after isolation} \end{array} - \begin{array}{c} \eta T_{I_S} \\ \text{hospitalized} \end{array} \quad (25)$$

$$(26)$$