Intectious time normalization

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This addresses T1.

We have prescribed values for the infectious periods for symptomatic ($gamma_I^{-1}$), severe (η^{-1}) and critical (α^{-1}) cases, and at the same time we have what fraction of the cases, for each age band, are severe (h_i) and critical (g_i). The fraction of cases in each group (symptomatic, severe, critical). Since the proportion of cases in each age band is given by the infectious periods, we add a correction coefficient depending on the each band. More precisely, let $a_i, b_i > 0$, and consider that the age-corrected rates are $a_i\eta$ for severe cases, $b_i\alpha$ for critical cases, and $((1 - a_i - b_i)\gamma_I$ for other symptomatic cases. The fractions of cases in each age band satisfy

$$h_i = \frac{a_i\eta}{(1 - a_i - b_i)\gamma_I + a_i\eta + b_i\alpha}, g_i = \frac{b_i\alpha}{(1 - a_i - b_i)\gamma_I + a_i\eta + b_i\alpha}.$$

We can explicitly find a_i, b_i:

$$a_i = \frac{\alpha h_i}{\eta g_i} b_i, b_i = \gamma_I \left(\frac{\alpha}{g_i} + \frac{\gamma_I \alpha h_i}{\eta g_i} + \gamma_I - \frac{\alpha h_i}{g_i} - \alpha \right)^{-1}.$$

The formulae are implemented in the script *infection_time_normalization.R*. The table below includes the results:

	Age 1	Age 2 no com.	Age 2 com.	Age 3 no com.	Age 3 com.
a_i	0.06382221	0.06643059	0.19129360	0.17818890	0.40633968
b_i	0.009259919	0.028328612	0.129085416	0.087633885	0.289590399

Implementation

To implement this in the model, we just need to replace the current h_i values by a_i, and the current g_i values by b_i.