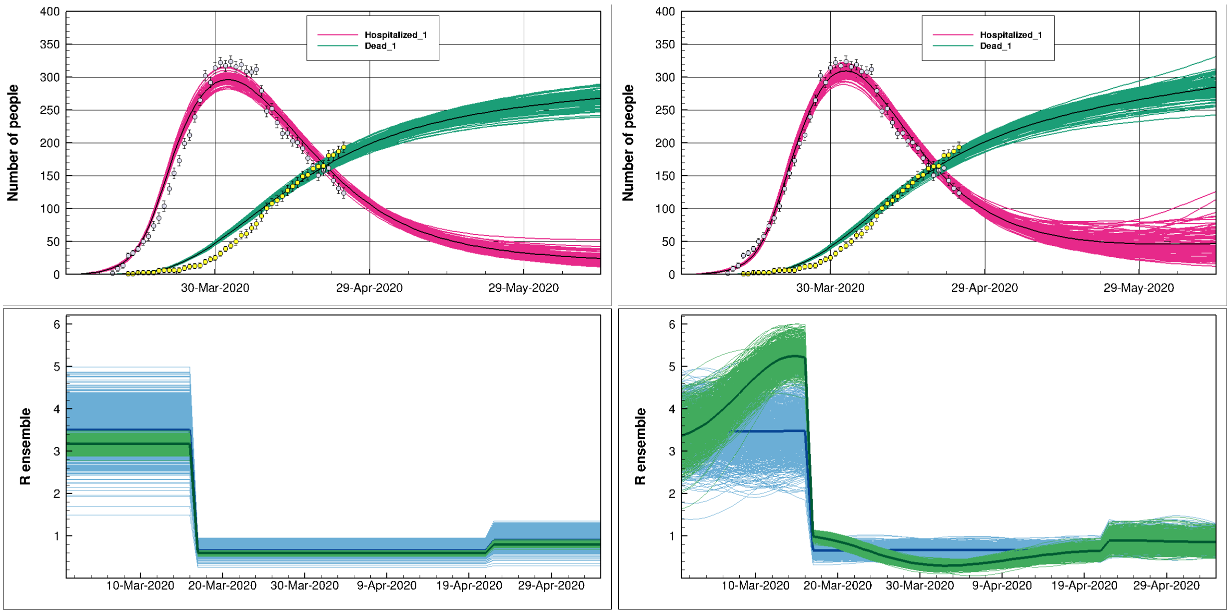
New SEIR with age compartments

Geir Evensen

Version compiled April 29, 2020



1 SEIR model with agecompartments

$$
\begin{cases}
\mathbf{S}_1 \rightarrow & \mathbf{E}_1 \rightarrow \mathbf{I}_1 \\
 & \vdots \\
\mathbf{S}_i \rightarrow & \mathbf{E}_i \rightarrow \mathbf{I}_i \\
 & \vdots \\
\mathbf{S}_n \rightarrow & \mathbf{E}_n \rightarrow \mathbf{I}_n
\end{cases}
\rightarrow
\begin{cases}
\mathbf{Q}_\mathrm{m} & & \rightarrow \mathbf{R}_\mathrm{m} \\
\mathbf{Q}_\mathrm{s} \rightarrow & \mathbf{H}_\mathrm{s} & \rightarrow \mathbf{R}_\mathrm{s} \\
\mathbf{Q}_\mathrm{f} \rightarrow & \mathbf{H}_\mathrm{f} & \rightarrow \mathbf{D} \\
\mathbf{Q}_\mathrm{f} \rightarrow & & \rightarrow \mathbf{D}
\end{cases}
\tag{1}
$$

The model equations are as follows:

$$
\frac{\partial \mathbf{S}_i}{\partial t} = -\frac{1}{\tau_\mathrm{inf}} \left(\sum_{j=1}^{n} R_{ij}(t)\, \mathbf{I}_j \right) \mathbf{S}_i - \frac{q_\mathrm{m} R(t)}{\tau_\mathrm{inf}} \mathbf{Q}_\mathrm{m} \mathbf{S}_i \tag{2}
$$

$$
\frac{\partial \mathbf{E}_i}{\partial t} = \frac{1}{\tau_\mathrm{inf}} \left(\sum_{j=1}^{n} R_{ij}(t)\, \mathbf{I}_j \right) \mathbf{S}_i - \frac{1}{\tau_\mathrm{inc}} \mathbf{E}_i + \frac{q_\mathrm{m} R(t)}{\tau_\mathrm{inf}} \mathbf{Q}_\mathrm{m} \mathbf{S}_i \tag{3}
$$

$$
\frac{\partial \mathbf{I}_i}{\partial t} = \frac{1}{\tau_\mathrm{inc}} \mathbf{E}_i - \frac{1}{\tau_\mathrm{inf}} \mathbf{I}_i \tag{4}
$$

$$
\frac{\partial \mathbf{Q}_\mathrm{m}}{\partial t} = \sum_{i=1}^{n} \frac{p_\mathrm{m}^i}{\tau_\mathrm{inf}} \mathbf{I}_i - (1/\tau_\mathrm{recm})\, \mathbf{Q}_\mathrm{m} \tag{5}
$$

$$
\frac{\partial \mathbf{Q}_\mathrm{s}}{\partial t} = \sum_{i=1}^{n} \frac{p_\mathrm{s}^i}{\tau_\mathrm{inf}} \mathbf{I}_i - (1/\tau_\mathrm{hosp})\, \mathbf{Q}_\mathrm{s} \tag{6}
$$

$$
\frac{\partial \mathbf{Q}_\mathrm{f}}{\partial t} = \sum_{i=1}^{n} \frac{p_\mathrm{f}^i}{\tau_\mathrm{inf}} \mathbf{I}_i - (1/\tau_\mathrm{hosp})\, \mathbf{Q}_\mathrm{f} \tag{7}
$$

$$
\frac{\partial \mathbf{H}_\mathrm{s}}{\partial t} = (1/\tau_\mathrm{hosp})\, \mathbf{Q}_\mathrm{s} - (1/\tau_\mathrm{recs})\, \mathbf{H}_\mathrm{s} \tag{8}
$$

$$
\frac{\partial \mathbf{H}_\mathrm{f}}{\partial t} = (h/\tau_\mathrm{hosp})\, \mathbf{Q}_\mathrm{f} - (1/\tau_\mathrm{death})\, \mathbf{H}_\mathrm{f} \tag{9}
$$

$$
\frac{\partial \mathbf{R}_\mathrm{m}}{\partial t} = (1/\tau_\mathrm{recm})\, \mathbf{Q}_\mathrm{m} \tag{10}
$$

$$
\frac{\partial \mathbf{R}_\mathrm{s}}{\partial t} = (1/\tau_\mathrm{recs})\, \mathbf{H}_\mathrm{s} \tag{11}
$$

$$
\frac{\partial \mathbf{D}}{\partial t} = (1/\tau_\mathrm{death})\, \mathbf{H}_\mathrm{f} + ((1-h)/\tau_\mathrm{hosp}) \mathbf{Q}_\mathrm{f} \tag{12}
$$