Supplementary Material II: Model equations

The impact of public health interventions on the future prevalence of *ESBL-producing Klebsiella pneumoniae:* a population based mathematical modelling study

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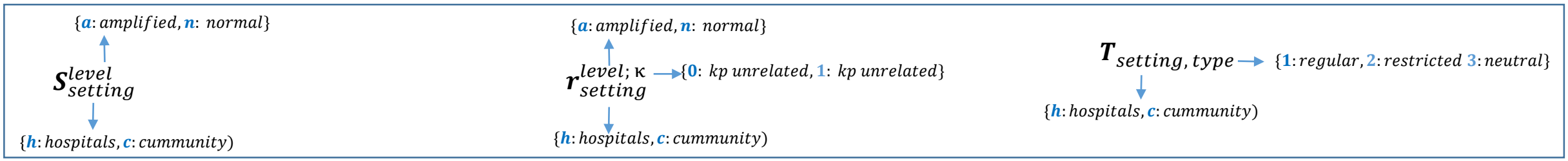

Model equations

$$\dot{S}^{n}_{setting} = (-1)^{\eta}\left(\theta(t)S^{n}_{setting=community} - \mu_h S^{n}_{setting=hospitals}\right) - \frac{1}{N_{setting}}\beta_{setting}\left(r^{n}_{setting} + \nu_i \sum_{\kappa\in\{0,1\}} r^{a;\kappa}_{setting}\right)S^{n}_{setting} - \sum_{type\in\{1,2,3\}} T_{setting,type}(t)\omega^{[type/3]}S^{n}_{setting} + T_{setting,type=2}(t)\lambda\left(r^{n}_{setting} + r^{a;\kappa=0}_{setting}\right) + \alpha_{setting}\left(S^{a}_{setting} + r^{n}_{setting} + \sum_{\kappa\in\{0,1\}} r^{a;\kappa}_{setting}\right) - \epsilon(t)S^{n}_{setting} + \lambda\left(T' - \phi_{setting}\right)r^{a;\kappa=1}_{setting}$$

$$\dot{S}^{a}_{setting} = (-1)^{\eta}\left(\theta(t)S^{a}_{setting=community} - \mu_h S^{a}_{setting=hospitals}\right) - \frac{1}{N_{setting}}\beta_{setting}\left(r^{n}_{setting} + \nu_i \sum_{\kappa\in\{0,1\}} r^{a;\kappa}_{setting}\right)S^{a}_{setting}\nu_s + \sum_{type\in\{1,2,3\}} T_{setting,type}(t)\omega^{[type/3]}S^{n}_{setting} - \alpha_{setting}S^{a}_{setting} - \epsilon(t)S^{a}_{setting}\nu_s$$

$$\dot{r}^{n}_{setting} = (-1)^{\eta}\left(\theta(t)r^{n}_{setting} - \mu_h r^{n}_{setting=hospitals}\right) + \frac{1}{N_{setting}}\beta_{setting}\left(r^{n}_{setting} + \nu_i \sum_{\kappa\in\{0,1\}} r^{a;\kappa}_{setting}\right)S^{n}_{setting} - \sum_{type\in\{1,2,3\}} T_{setting,type}(t)\omega^{[type/3]}r^{n}_{setting} - T_{setting,type=2}(t)\lambda r^{n}_{setting} - \alpha_{setting}r^{n}_{setting} + \epsilon(t)S^{n}_{setting}$$

$$\dot{r}^{a;\kappa=1}_{setting} = (-1)^{\eta}\left(\theta_h(t)S^{a}_{setting} - \mu_h r^{a;\kappa=1}_{setting=hospitals}\right) + \sum_{type\in\{1,2,3\}} T_{setting,type}(t)\omega^{[type/3]}r^{n}_{setting}\kappa - \alpha_{setting}r^{a;\kappa=1}_{setting} - \lambda\left(T' - \phi_{setting}\right)r^{a;\kappa=1}_{setting} - \phi_{setting}r^{a;\kappa=1}_{setting}$$

$$\dot{r}^{a;\kappa=0}_{setting} = (-1)^{\eta}\left(\theta(t)S^{a}_{setting} - \mu_h r^{a;\kappa=0}_{setting=hospitals}\right) + \frac{1}{N_{setting}}\beta_{setting}\left(r^{n}_{setting} + \nu_i \sum_{\kappa\in\{0,1\}} r^{a;\kappa}_{setting}\right)S^{a}_{setting}\nu_s + \sum_{type\in\{1,2,3\}} T_{setting,type}(t)\omega^{[type/3]}r^{n}_{setting}(1-\kappa) - T_{setting,type=2}(t)\lambda r^{a;\kappa=0}_{setting} - \alpha_{setting}r^{a;\kappa=0}_{setting} + \epsilon(t)S^{a}_{setting}\nu_s + \phi_{setting}r^{a;\kappa=1}_{setting}$$

Where:

- Superscripts n : *normal* and a : *amplified* represent levels of susceptibility to and infectiousness of colonization.
- Subscript $setting = \{hospitals, community\}$
- $\kappa = 1$ indicates resistance associated with erroneous treatment of an infection associated with *ESBL-producing Klebsiella pneumoniae*
- $N_{setting}$ denotes the total population in each setting
- $\eta = \begin{cases} 0, & \text{if } setting = h \\ 1, & \text{if } setting = c \end{cases}$
- $\kappa = 1$ indicates resistance associated with erroneous treatment of an infection associated with *ESBL-producing Klebsiella pneumoniae*