Table 1: Model parameters and assumptions

Parameter	Description	Base value	Source
	Transmission parameters		
β_1	Probability of transmission from infected patients, per day	0.0074	Fitted[#]
β_2	Probability of transmission from colonised patients, per day	0.0037	Fitted[#]
λ_t	Probability of a susceptible patient becoming colonised, per day	$1-(1-\beta_1)^{It}(1-\beta_2)^{Ct}$	
	Patient parameters		
θ	Incubation time (days)	18 (Gamma)	[12]
s	Duration of symptoms (days)	4 (Poisson)	[12,50]
c	Duration of colonisation (days)	30 (Exponential)	[48, 49]
L_{icu}	Average length of ICU stay	6	[53]
α_{gm}	Fraction of patients admitted from GM on antimicrobials on admission to the ICU	0.081	PPS[55][*#]
α_{icu}	Fraction of patients on antimicrobials in the ICU on a given day	0.219	PPS[55][*#]
p_{icu}	Probability of initiating high risk antimicrobials in ICU ward per day	$p_{icu} = 1-(1-\alpha_{icu})^{1/Licu}$	
α_{ltcf}	Fraction of patients directly admitted from LTCF on antimicrobials on admission to the ICU	0.040	PPS[58,59][*]
α_{com}	Fraction of patients directly admitted from the community on antimicrobials on admission to the ICU	0.012	PPS[60,61][*]
$f_{ltcf} = f_{com}$	Fraction of patients admitted to ICU from the LTCF/ community that develop a natural immune response against disease	0.240	[47][*]
a_{i_ltcf}	Fraction of patients from LTCF that were infected on admission to the ICU	0.050	H[*]
a_{c_ltcf}	Fraction of patients from LTCF that were colonised on admission to the ICU	0.010	H[*]
a_{s_ltcf}	Fraction of patients from LTCF that were susceptible on admission to the ICU	$a_{ltcf} -(a_{i\_ltcf} + a_{c\_ltcf})$	-
a_{i_com}	Fraction of patients from the community that were infected on admission to the ICU	0.003	H
a_{c_com}	Fraction of patients from the community that was colonised on admission the ICU	0.028	H
a_{s_com}	Fraction of patients coming from the community that was susceptible on admission to the ICU	$(1- a_{ltcf})-(a_{i\_com} + a_{c\_com})$	-
	Movement parameters		
a_{ltcf}	Fraction of patients admitted from LTCF	0.040	PPS[42]
a_{direct_icu}	Fraction of patients admitted directly into ICU from any community setting	0.510	HES
$a_{elect\_icu\_ltcf}$	Fraction of patients in the ICU that were admitted for elective surgery from LTCF	0.110	HES
$a_{elect\_icu\_com}$	Fraction of patients in the ICU that were admitted for elective surgery from community	0.300	HES
d_n	Daily probabilities of discharge from the ICU for protected, susceptible and asymptomatic patients	Appendix	Appendix
d_i	Daily probabilities of discharge from the ICU for infected patients	Appendix	Appendix
μ_n	Daily probabilities of death in the ICU for protected, susceptible and asymptomatic patients	Appendix	Appendix

$\mu_{i=}\ \mu_n$	Daily probabilities of death in the ICU for infected patients	Appendix	Appendix
r_{ltcf}	Probability of readmission for LTCF residents within three months	0.220	HES
r_{com}	Probability of readmission for community residents within three months	0.120	HES
τ	Mean time between discharge and readmission (days)	29 (Exponential)	HES
	Vaccination parameters		
e	The probability of vaccination resulting in successful acquired immunity (vaccine efficacy)	1	A[#]
ε	Duration of vaccine-acquired immunity (years)	2	A
$a_{elect\_hospital}$	Fraction of hospital admission that are elective	0.504	HES[53]
a_{icu}	Fraction of hospital admissions that involve an ICU stay	0.018	HES[54]
B_{ltcf}	Median number of beds per LTCF	37	CQC
N_{ltcf}	Total number of LTCFs in England with a size of ≥20 beds	8,639	CQC
N_{trust}	Total number of acute Trusts reporting ICU records in England	143	HES[54]
t	Simulation time (years)	5	-