Dynamic modeling of personal protection control strategies for vector-borne disease limits the role of diversity amplification: Supplementary material

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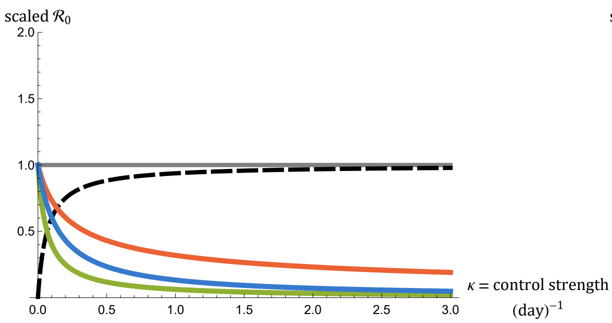
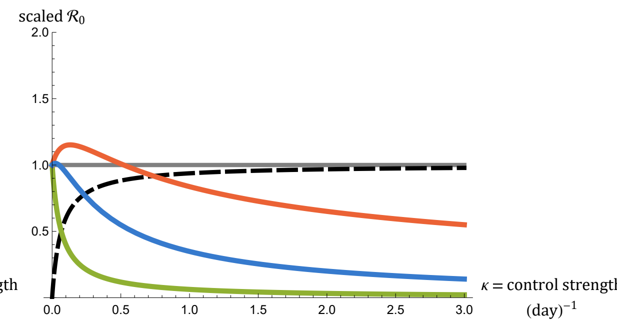
S1 Effects of varied human recovery time

The following plots are the equivalent of Figs. 1 - 4 in the main text for a human recovery times $1/r = 1$ week and $1/r = 6$ months. The dynamic two-class model behaves more similarly to the static two-class model for shorter recovery times, and more similarly the one-class model for longer recovery times.

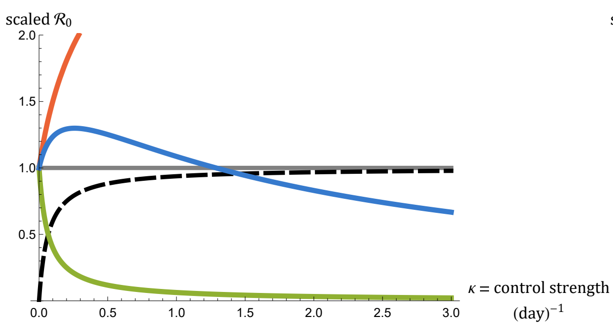
S1.1 One week recovery time



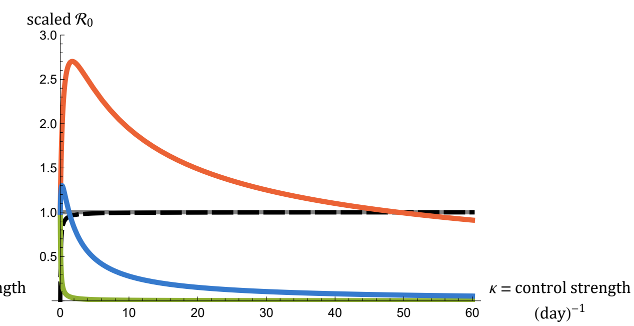
(a) Density-dependent infection $AN_h = 0.1\ \text{day}^{-1}$



(b) Moderate infection $AN_h = 1.0\ \text{day}^{-1}$

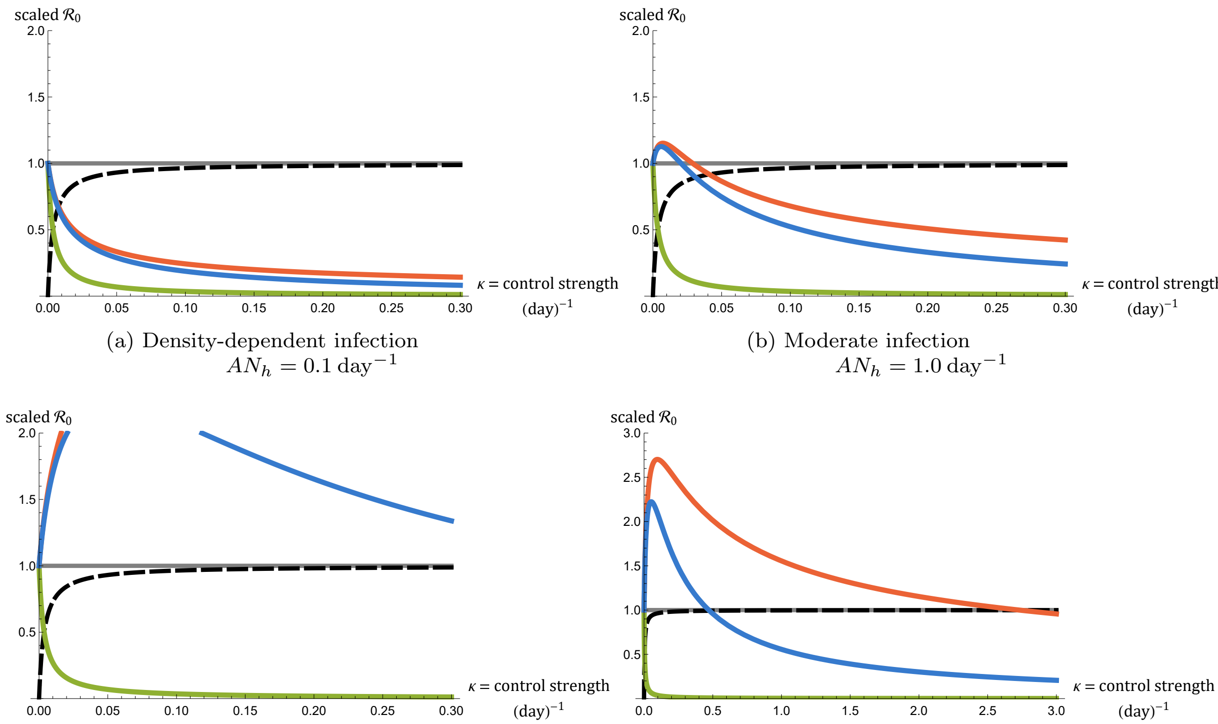


(c) Frequency-dependent infection $AN_h = 10.0\ \text{day}^{-1}$



(d) Frequency-dependent infection (wide view)

Figure S1: Dependencies of $\mathcal{R}_0$ on DEET ($1/\gamma = 15$ days) control strength for the dynamic two-class model **(blue)**, static two-class model **(red)**, and one-class model **(green)**, where the human recovery time $1/r = 1$ week. Corresponding equilibrium proportions of protected hosts are given by the dashed black curve. Two-host models display diversity amplification at control strengths where respective scaled $\mathcal{R}_0$ curves rise above the gray $\mathcal{R}_0 = 1$ line.



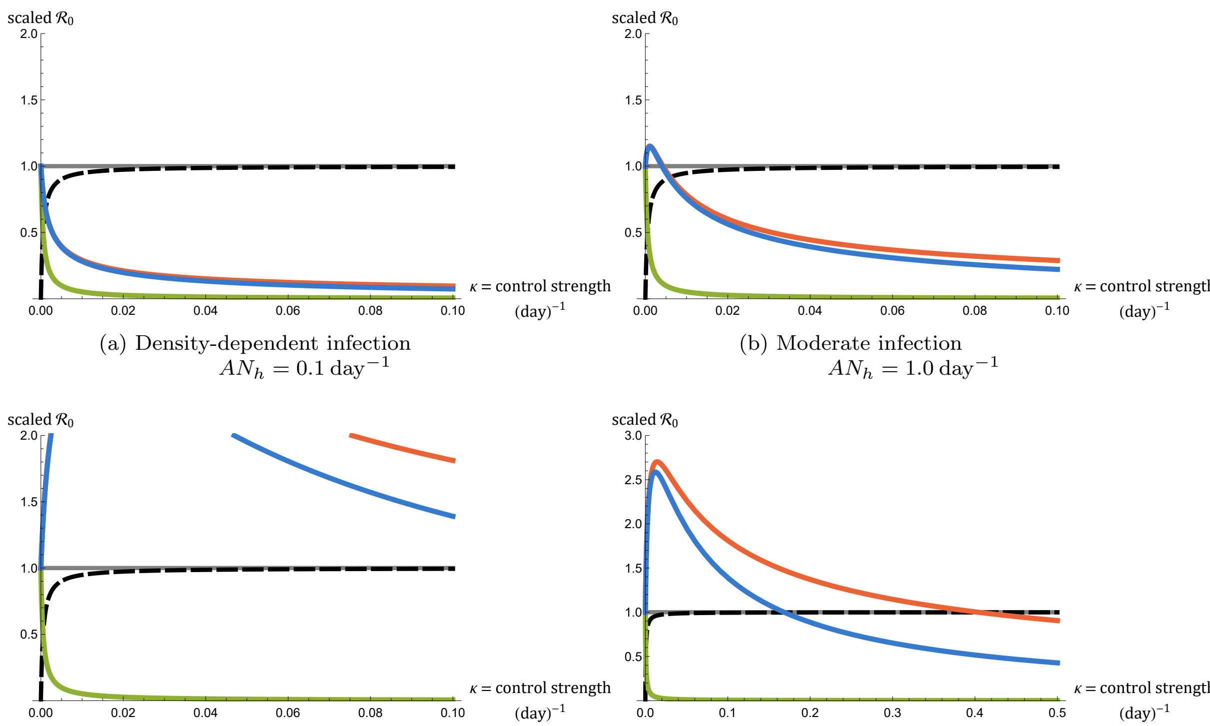
(a) Density-dependent infection
$AN_h = 0.1$ day^{-1}

(b) Moderate infection
$AN_h = 1.0$ day^{-1}

(c) Frequency-dependent infection
$AN_h = 10.0$ day^{-1}

(d) Frequency-dependent infection
(wide view)

Figure S2: Dependencies of $\mathcal{R}_0$ on intermediate protection ($1/\gamma = 9$ months) control strength, where the human recovery time $1/r = 1$ week. Curve colors and styles are defined as in Fig. S1.



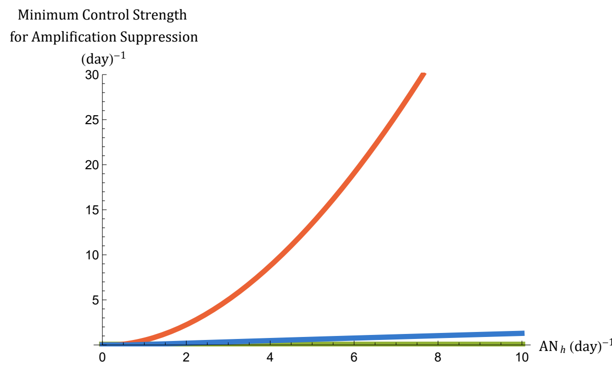
(a) Density-dependent infection
$AN_h = 0.1\,\mathrm{day}^{-1}$

(b) Moderate infection
$AN_h = 1.0\,\mathrm{day}^{-1}$

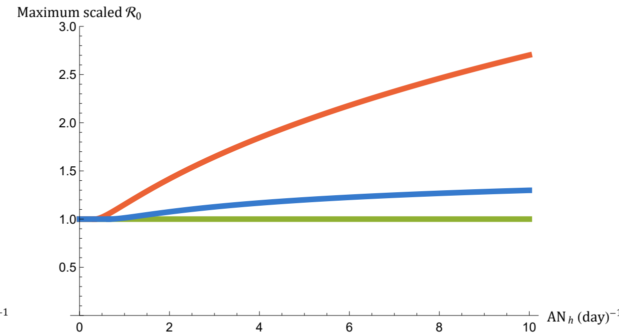
(c) Frequency-dependent infection
$AN_h = 10.0$

(d) Frequency-dependent infection
(wide view)

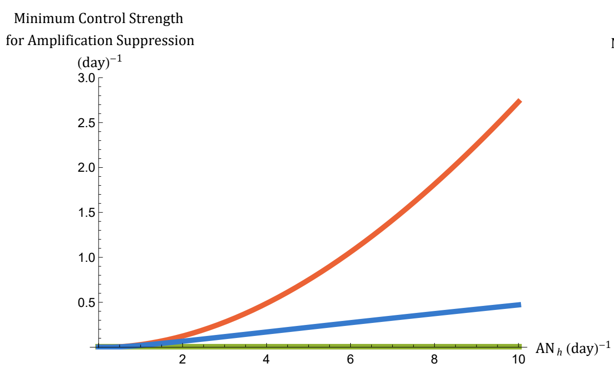
Figure S3: Dependencies of $\mathcal{R}_0$ on bed net ($1/\gamma = 5$ years) control strength, where the human recovery time $1/r = 1$ week. Curve colors and styles are interpreted as in Fig. S1.



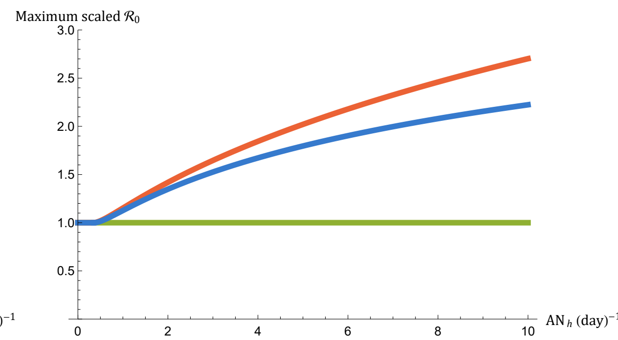
(a) Amplifaction Range Reduction
$1/\gamma = 15$ days



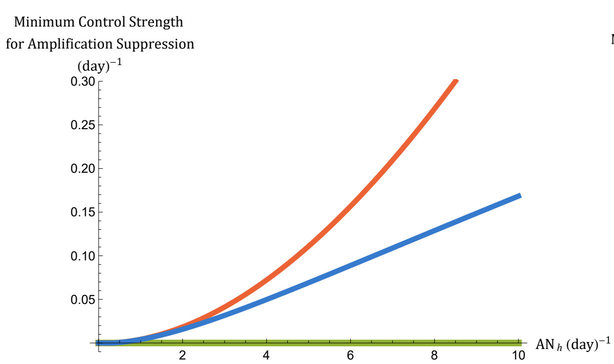
(b) Amplifaction Severity Reduction
$1/\gamma = 15$ days



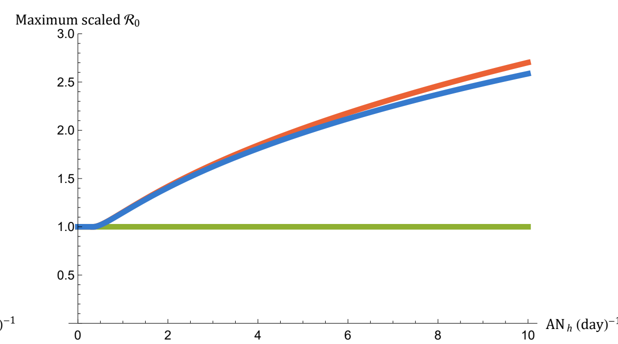
(c) Amplifaction Range Reduction
$1/\gamma = 9$ months



(d) Amplifaction Severity Reduction
$1/\gamma = 9$ months



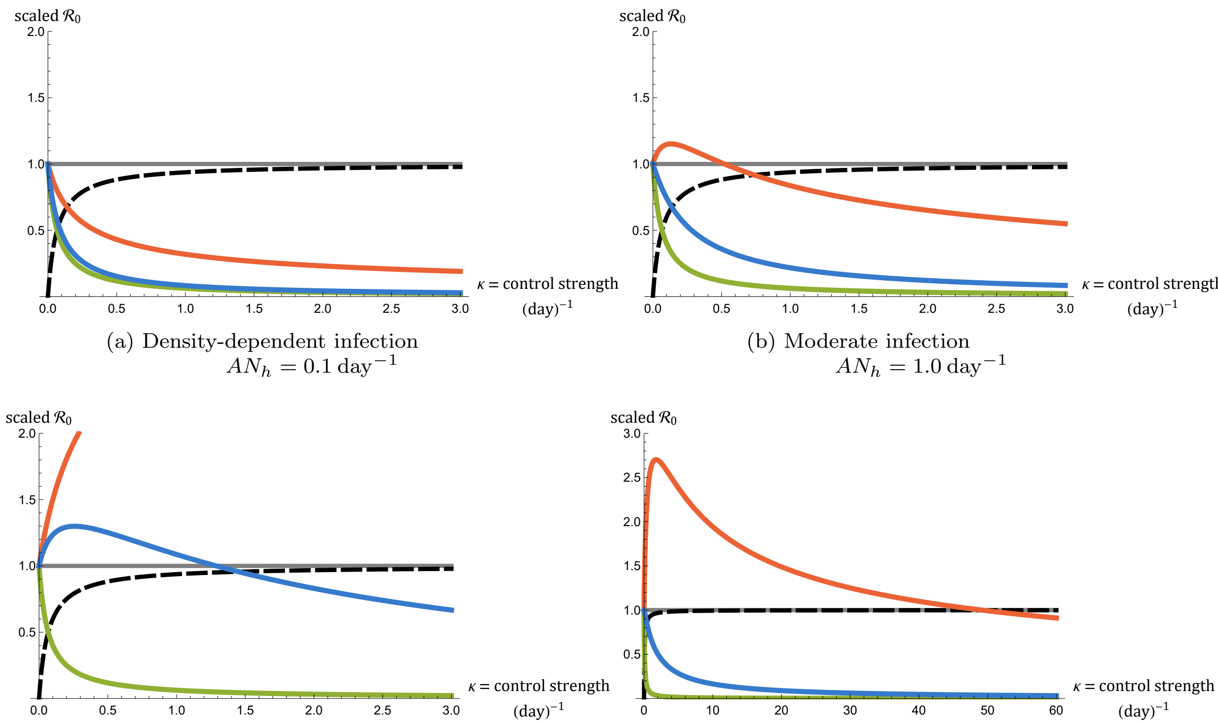
(e) Amplifaction Range Reduction
$1/\gamma = 5$ years



(f) Amplifaction Severity Reduction
$1/\gamma = 5$ years

Figure S4: Illustrations of amplification range and strength reduction as functions of AN_h using the dynamic two-class model**(blue)**, static two-class model **(red)**, and one-class model **(green)**, where the human recovery time $1/r = 1$ week. The minimum control strength for amplification suppression is the value of control strength κ^* such that scaled $\mathcal{R}_0$ exceeds unity for all control strengths $\kappa \in [0, \kappa^*]$. The maximum scaled $\mathcal{R}_0$ is the value of scaled $\mathcal{R}_0$ at the peak of a model's $\mathcal{R}_0$ vs κ curve for a given value of AN_h.

S1.2 Six month recovery time



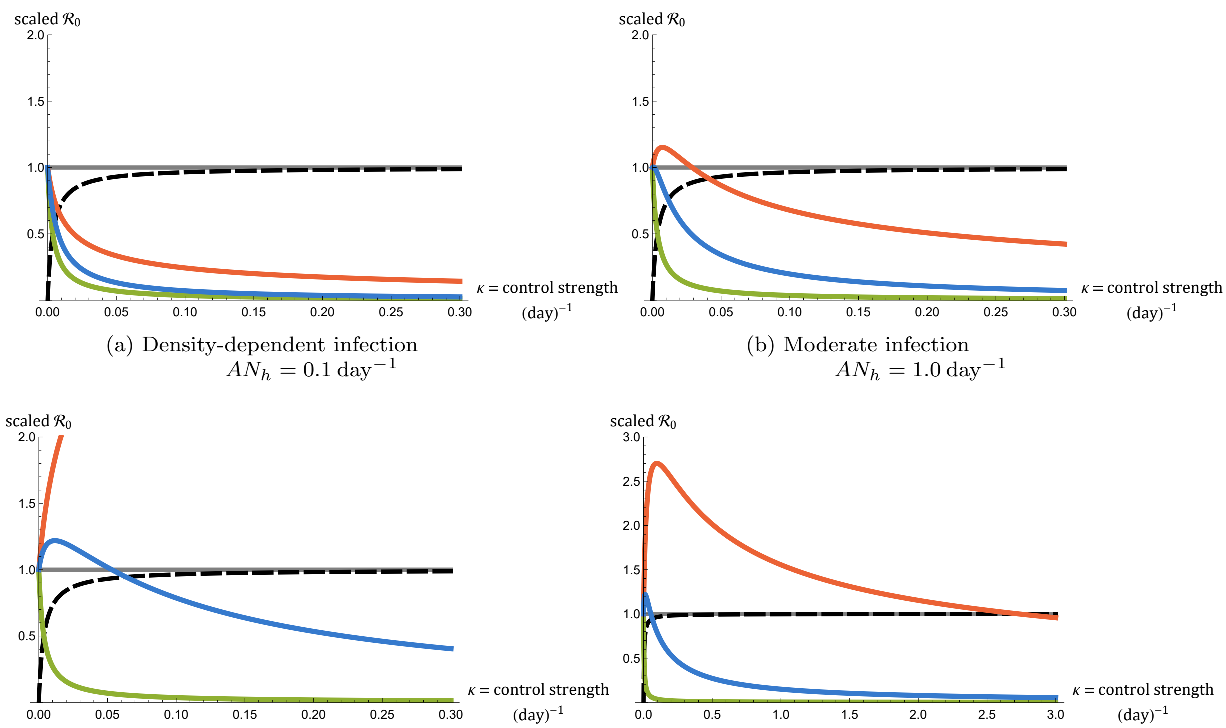
(a) Density-dependent infection
$AN_h = 0.1\,\text{day}^{-1}$

(b) Moderate infection
$AN_h = 1.0\,\text{day}^{-1}$

(c) Frequency-dependent infection
$AN_h = 10.0\,\text{day}^{-1}$

(d) Frequency-dependent infection
(wide view)

Figure S5: Dependencies of $\mathcal{R}_0$ on DEET ($1/\gamma = 15$ days) control strength for the dynamic two-class model **(blue)**, static two-class model **(red)**, and one-class model **(green)**, where the human recovery time $1/r = 6$ months. Corresponding equilibrium proportions of protected hosts are given by the dashed black curve. Two-host models display diversity amplification at control strengths where respective scaled $\mathcal{R}_0$ curves rise above the gray $\mathcal{R}_0 = 1$ line.



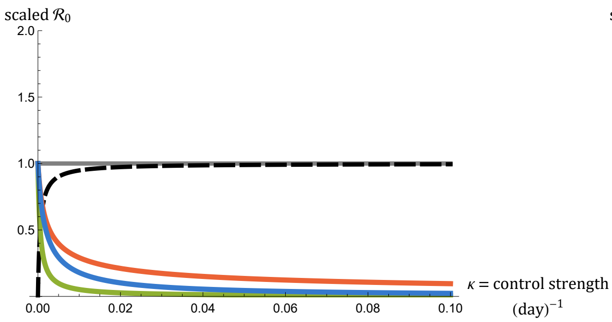
(a) Density-dependent infection
$AN_h = 0.1\ \text{day}^{-1}$

(b) Moderate infection
$AN_h = 1.0\ \text{day}^{-1}$

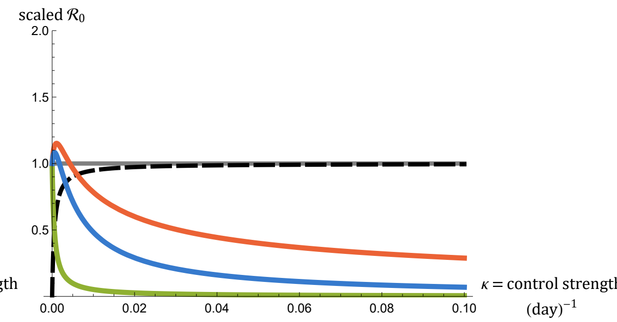
(c) Frequency-dependent infection
$AN_h = 10.0\ \text{day}^{-1}$

(d) Frequency-dependent infection
(wide view)

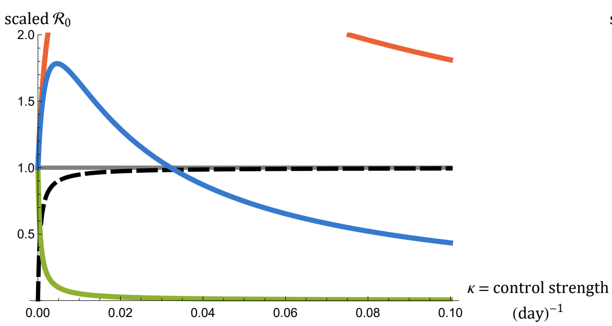
Figure S6: Dependencies of $\mathcal{R}_0$ on intermediate protection ($1/\gamma = 9$ months) control strength, where the human recovery time $1/r = 6$ months. Curve colors and styles are defined as in Fig. S1.



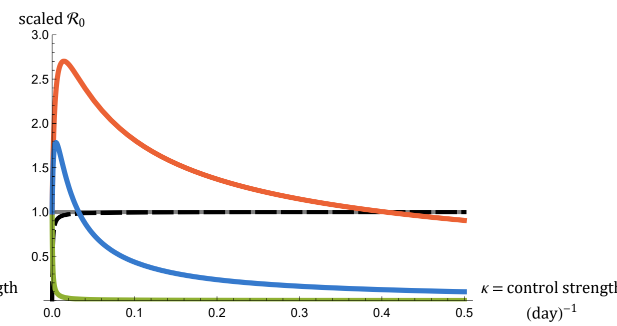
(a) Density-dependent infection
$AN_h = 0.1 \text{ day}^{-1}$



(b) Moderate infection
$AN_h = 1.0 \text{ day}^{-1}$

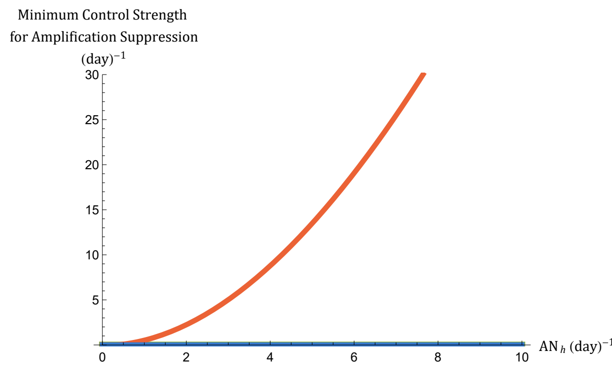


(c) Frequency-dependent infection
$AN_h = 10.0$

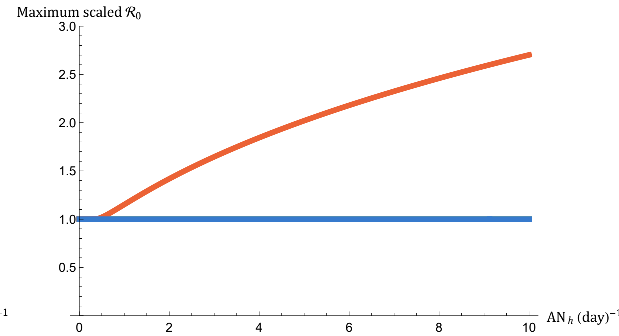


(d) Frequency-dependent infection
(wide view)

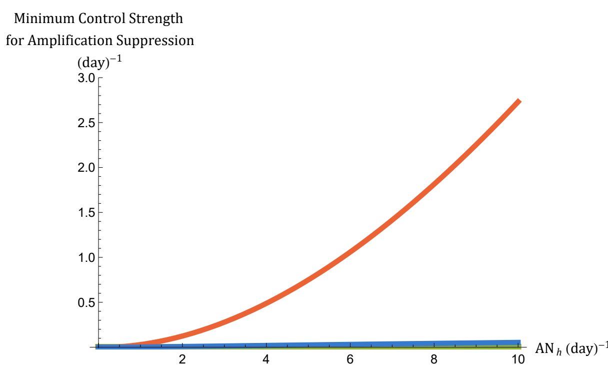
Figure S7: Dependencies of $\mathcal{R}_0$ on bed net ($1/\gamma = 5$ years) control strength, where the human recovery time $1/r = 6$ months. Curve colors and styles are interpreted as in Fig. S1.



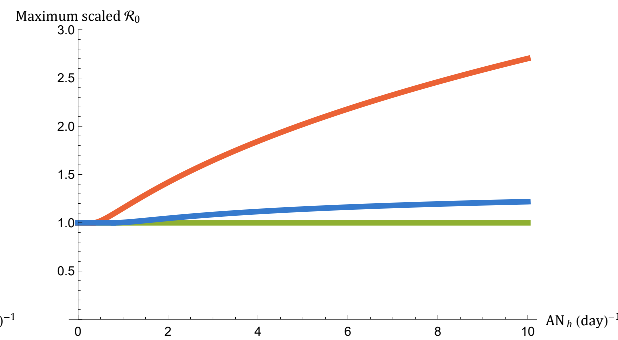
(a) Amplifaction Range Reduction
$1/\gamma = 15$ days



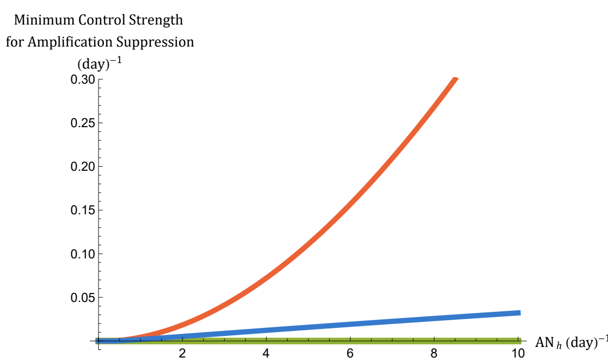
(b) Amplifaction Severity Reduction
$1/\gamma = 15$ days



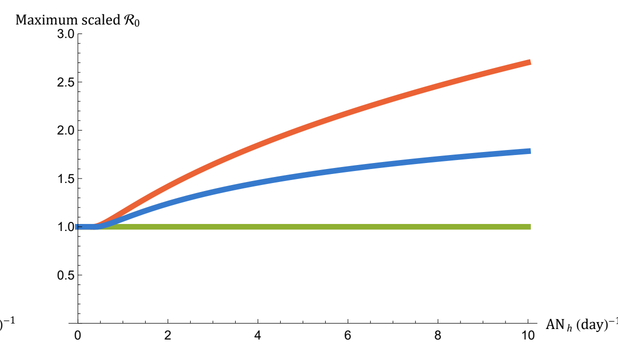
(c) Amplifaction Range Reduction
$1/\gamma = 9$ months



(d) Amplifaction Severity Reduction
$1/\gamma = 9$ months



(e) Amplifaction Range Reduction
$1/\gamma = 5$ years



(f) Amplifaction Severity Reduction
$1/\gamma = 5$ years

Figure S8: Illustrations of amplification range and strength reduction as functions of AN_h using the dynamic two-class model**(blue)**, static two-class model **(red)**, and one-class model **(green)**, where the human recovery time $1/r = 6$ months. The minimum control strength for amplification suppression is the value of control strength κ^* such that scaled $\mathcal{R}_0$ exceeds unity for all control strengths $\kappa \in [0, \kappa^*]$. The maximum scaled $\mathcal{R}_0$ is the value of scaled $\mathcal{R}_0$ at the peak of a model's $\mathcal{R}_0$ vs κ curve for a given value of AN_h.