Equation 1 B,P and I are bacteria, phage and immunity cells respectively.The parameters r and KC are the maximum growth rate and carrying capacity of the bacteria respectively. In this study we only consider liner relationship in phage lysis, the proportion coefficient is φ.ɛ represent the maximum per-capita killing rate of the immune response,bacteria with a maximum activation rate isα,effective burst size is β, phage decay rate is ω and immunity cells decay rate is ωI . KD is the bacterial density at the half effective of immune response. KI and KN are maximum capacity of immunity cells and bacterial density of the immune intensity growth rate is half its maximum respectively.

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| Parameter | Value | Referance |
| r, growth rate of bacteria at low density | 1 h-1 | A. baumannii and P. aeruginosa (Guo et al., 2011) |
| KC, carrying capacity of bacteria | 109 ml-1 | Bacterial load of P. aeruginosa in lung tissue of immunosuppressed mice (Guo et al., 2011) |
| β, burst size of phage | 100 | This study |
| ϕ, adsorption rate of phage | 5 ×10-8 ml h-1 | Within the range for Lambda phage (Shao and Wang, 2008) and other coliphage (De Paepe and Taddei, 2006) |
| ω, decay rate of phage | 1 h-1 | Clearance of phage from blood of mice (Hodyra-Stefaniak et al., 2015) |
| α, maximum growth rate of innate immune response | 0.97 h-1 (strong immunity)  0.05 h-1 (weak immunity) | Fitting of interstitial neutrophil recruitment data in LPS-induced acute lung injury (Reutershan et al., 2005) |
| I0, initial innate immune intensity | 2.7 × 106 ml-1 | Fitting of neutrophil recruitment data in acute lung injury (Reutershan et al., 2005) |
| KI, maximum capacity of innate immune response | 2.4 × 107 ml-1 | Fitting of neutrophil recruitment data in acute lung injury (Reutershan et al., 2005) |
| ϵ, killing rate parameter of innate immune response | 8.2 × 10-8 ml h-1(with immunity)  0 ml h-1 (without immunity) | Set such that ϵKI gives 1.97 h-1 the fitted maximum killing rate of neutrophils in a murine model of pneumonia (Drusano et al., 2011) |
| KD, bacterial concentration at which innate immune response is half saturated | 2.2 × 106 ml-1 | Fitted parameter in a murine model of pneumonia by P. aeruginosa (Drusano et al., 2011) |
| KN, bacterial concentration when innate immune response growth rate is half its maximum | 105 ml-1 | Effect of bacterial burden on macrophage recruitment rate in Mycobacterium tuberculosis infection (Sadek, Sada, Toossi, Schwander, Rich, 1998, Wigginton, Kirschner, 2001) |
| B0, initial bacterial density | 106 ml-1 | Typical bacterial inoculum used for in vivo growth experiments of P. aeruginosa and S. aureus (Drusano, Fregeau, Liu, Brown, Louie, 2010, Drusano, VanScoy, Liu, Fikes, Brown, Louie, 2011) |
| P0, initial phage dose | 107 ml-1 | Set to give a multiplicity of infection (MOI) of 10 required to ensure effective phage therapy (Debarbieux, Leduc, Maura, Morello, Criscuolo, Grossi, Balloy, Touqui, 2010, Semler, Goudie, Finlay, Dennis, 2014) |
| ωI, decay rate of phage | 0.05 h-1 (strong immunity)  0.005 h-1 (weak immunity) | Self-defining |

Table 1 Model parameters.