SUPPLEMENTARY MATERIAL

Assessing the burden of pregnancy associated malaria under changing transmission settings

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Steady state under stable disease transmission (λ_s=0)

Assuming a constant birth rate *B*, stable transmission (λ_s=0) and ignoring other demographic factors, system (1) converges towards a steady-state equilibrium given by:

$$\begin{aligned} &G := N_0 = \frac{B}{m+\mu}, \quad N_i = mc^{i-1}\left(\frac{1-\lambda}{c+\mu}\right)^i N_0, \\ &R_i = \frac{cm\lambda(1-\alpha)}{c+\mu}\sum_{j=0..i}\left(\frac{c}{c+\mu}\right)^{i-j} N_j, \; P = \frac{c}{\mu}\left(R_H + (1-\alpha\lambda)N_H\right), \end{aligned} \tag{2}$$

where capital letters denote equilibrium values. Within this framework we define excess morbidity, *E*, simply by the rate pregnant women move out of the susceptible classes *g* and n_i multiplied by the probability of contracting PAM, λ; that is

$$E = E_P + E_M \quad \text{with} \quad E_P = m\lambda G, \quad E_M = \sum_{i=1..H} E_i = \sum_{i=1..H} c\lambda N_i \tag{3}$$

where E_P and E_M denote excess morbidity of the primi- and multigravidae classes, respectively.

Maximum in excess morbidity in the multigravidae classes

From Figure 5 (main text) it is clear that the excess morbidity within the multigravidae class assumes a local maximum. From (3) and (4) we find $E_i^{\max}$ exactly when:

$$\frac{\partial}{\partial\lambda}E_i = \frac{\partial}{\partial\lambda}\left(c\lambda N_i\right) = 0 \quad \Leftrightarrow \quad \lambda_i^{\max} = \frac{1}{1+i}. \tag{4}$$

($\lambda = 0$ and $\lambda = 1$ are the local minima.) This means that the highest impact of PAM on senior gravid women occurs at lower levels of transmission than on women in earlier pregnancies. And because $E_i^{\max}$ is a decreasing function in *i*, the total excess in morbidity from multigravidae, $E_M^{\max}\left(=\sum_{i=1..H} E_i^{\max}\right)$, is observed at intermediate levels of transmission intensity. Unfortunately, the exact value of $\lambda^{\max}$ requires solving a polynomial of degree *H* but we can find a good approximation in:

$$\lambda^{\max} \approx \sum_{i=1..H} a^i \lambda_i^{\max} / \sum_{i=1..H} a^i \,, \qquad (5)$$

with $a = c/c + \mu$. As such, $\lambda^{\max}$ depends on the average number of pregnancies per female, *H*, and, to a smaller degree, on the duration of the period between consecutive pregnancies, *c*. Therefore, as the lifetime number of pregnancies increases, the maximum impact of PAM induced excess morbidity occurs at lower transmission intensities.