Let \( Y_{E_1} \) and \( Y_{E_2} \) denote two binary efficacy endpoints, following a multinomial distribution with four elementary outcomes: \((Y_{E_1}, Y_{E_2}) = (1, 1), (1, 0), (0, 1) \) and \((0, 0)\). Let \( p_{E_1} = Pr(Y_{E_1} = 1) \), \( p_{E_2} = Pr(Y_{E_2} = 1) \) and \( p_{E_1\&E_2} = Pr(Y_{E_1} = 1, Y_{E_2} = 1) \). BOP2 assumes that the probabilities of observing the four possible outcomes of \((Y_{E_1}, Y_{E_2})\) following a Dirichlet prior \( \text{Dir}(n_{11}, n_{10}, n_{01}, n_{00}) \), where \( n_{11}, n_{10}, n_{01} \) and \( n_{00} \) are determined based on user’s input “Prob(Eff1)” (denoted as \( \hat{p}_{E_1} \)), “Prob(Eff2)” (denoted as \( \hat{p}_{E_2} \)), “Prob(Eff1\&Eff2)” (denoted as \( \hat{p}_{E_1\&E_2} \)) and “Prior effective sample size” (denoted as \( n_0 \)) as follows:

\[
\frac{n_{10}}{n_{11} + n_{10} + n_{01} + n_{00}} = \hat{p}_{E_1}, \quad \frac{n_{01}}{n_{11} + n_{10} + n_{01} + n_{00}} = \hat{p}_{E_2}, \quad \frac{n_{11}}{n_{11} + n_{10} + n_{01} + n_{00}} = \hat{p}_{E_1\&E_2}, \quad n_{11} + n_{10} + n_{01} + n_{00} = n_0
\]