

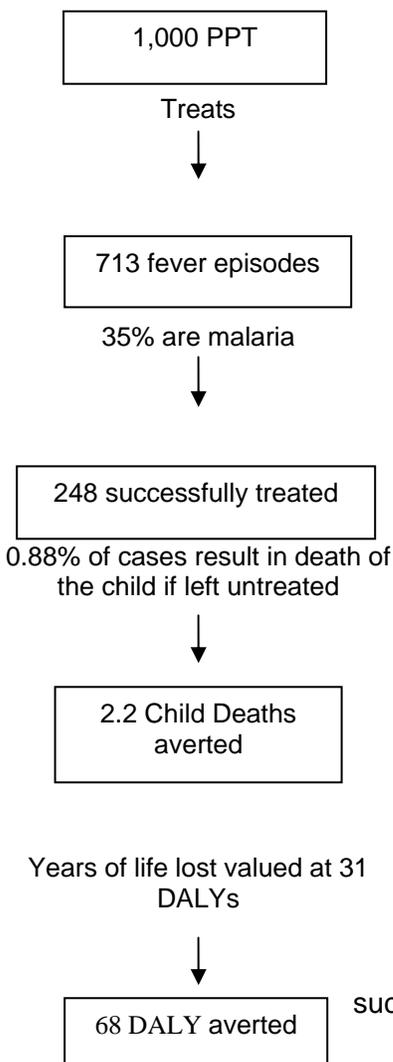


DALY Calculation for Malaria PPT (ACT) & Rapid Diagnostic Kit (RDK)

1,000 ACT PPT = 68 DALY averted for children aged 0-4 in Nigeria

The sale of 1,000 Artemisinin-based combination therapies (ACT) in the form of a pre-packed treatment (PPT) in Nigeria averts 68 DALY, or 68 years of healthy life that would have been lost without PSI's intervention. The difference in calculating DALY for treatment and prevention products can be expressed in terms of targeting. Treatment products are almost perfectly targeted because the beneficiary is someone who is already suffering from the condition (save for misdiagnosis and wastage). For example, a bed net may be used to protect children who would not have become infected with malaria. How much of a prevention product is wasted depends on the level of risk in the population and the effectiveness of the targeting efforts. Since treatment products are mostly consumed by people who are already sick this means less wastage and therefore higher unit effectiveness.

One DALY (Disability Adjusted Life Year) represents one year of life lost to illness or death. The PSI DALY Translation Model estimates how many DALY are averted due to PSI interventions, by using burden estimates and epidemiological probability models.



DALY Calculation for 1,000 Malaria PPTs (ACT)

Malaria PPT is a treatment product. Thus, when we calculate DALYs averted with PPT, we have to incorporate whom we are treating. In this example the product is being used to treat children under five years old who are already suspected to be suffering from malaria. The calculation of DALY averted from the sale of PPT is based on the following factors:

- Demographic sub group (age and location)
- Protective Benefit – *how many units* of the product are required for treatment of one episode, what level of *adherence* is estimated and what is the *efficacy* of the intervention in question in terms of preventing negative outcomes.
- The burden of the disease being treated (or prevented) in the sub group in question in the country in question.

One thousand ACT PPT will result in, on average, the effective treatment of 248 episodes of malaria. It is expected that 5% of all PPT sold will be lost to wastage. ACT is estimated to be 92% effective in successfully treating malaria in Nigeria if compliance with the drug regimen is complete. It is also estimated that about 82% of those who receive the PPT will properly adhere. Finally in home-treatment in Africa most malaria is treated symptomatically – that is the decision to treat is based on the appearance of symptoms, in this case fever - the proportion of those who are treated who do in fact have malaria is about 35%. As a result of 1,000 PPT, 248 are effectively treated ($1000 * (1-0.05) * 0.92 * 0.82 * 0.35$).

Malaria is common in Nigeria, where children aged 0-4 have an average of between one and two episodes per year. Yet, only a small proportion of such episodes lead to death with a case fatality rate averaging at 0.88% (or a

probability of 0.0088)¹. This means that in successfully treating 248 episodes we have prevented 2.2 deaths ($248 * 0.0088$). For each death that has been averted from successful treatment of diarrheal disease this is equivalent to averting 31 YLL (years of lost life).² Thus, in our example a total of **68 YLL** is averted.

¹ Please see page two, first bullet under YLL for details of this calculation.

² Please see page two, second bullet under YLL for DALY calculation of years of life lost.

Details for Number Crunchers

:: Targeting

In this example each Malaria PPT (ACT) treats a child aged 0-4 years with fever (suspected malaria).

:: Estimating Impact

Units needed for treatment * (1 – wastage) * adherence rate * clinical efficacy of product * diagnostic specificity

Number of units needed for treatment: 1 PPT treats one case of suspected malaria

- :: Wastage: 5%.
- :: Adherence: 81.64%³
- :: Clinical Efficacy: 91.95%³
- :: Proportion of fevers treated that are malaria: 34.81%³

Number of fever episodes treated: (1,000 PPT / 1 per episode) * (1 – 0.05) * 0.8164 * 0.9195 = 713

Effective fever episodes treated: 713 episodes treated * 34.81% confirmed as malaria = 248

:: Years of Life Lost due to premature death (YLL)

Case fatality rate * discounted value of life years lost to death from malaria

- :: Case fatality rate: Imputed from number of deaths per year divided by number of cases per year. Mortality rate from malaria is 12.53 per 1,000 children under-5 in Nigeria, or 0.01253.⁴ The average number of episodes per child is 1.424⁵. The case fatality rate is therefore 0.01253/1.424 = 0.0088, or 0.88%.
- :: Years of Life Lost to death: 1.8 is used as the mean age of death for children aged 0-4 years, and this is then subtracted from the constant optimal life expectancy of 81.25 years. Those years lost are then discounted by 3% to estimate their value in the current year. This yields 31 YLL per child death.⁶

YLL calculation: 248 episodes effectively treated * Case fatality rate of 0.88% * 31 YLL per child death = **68 DALY averted**.

:: Years Lost to Disability or illness (YLD)

Since PPT does not prevent a case of malaria, but treats it, this part of the DALY is valued at 0.

Rapid Diagnostic Kit (RDK)

The value of an RDK lies in its ability to give greater confidence in the confirmation of the malaria diagnosis. With symptomatic diagnosis in this example, about 65% of treated fevers were not malaria. If this process of dilution of impact were removed or reduced it would improve the effectiveness of each unit of PPT. The improvement in specificity of diagnosis from the use of an RDK can be estimated using the following formula:

$RDK_i = (PPV - \%fevers+) - (1 - NPV)$, where RDK_i = the incremental benefit gained from an RDK, PPV = positive predictive value, and NPV = negative predictive value.

For values here RDK (PPV) = 0.79; RDK (NPV) = 0.91; %fever+; 0.3481, so; $RDK_i = (0.79 - 0.3481) - (1 - 0.91) = 0.3519$. Multiply this by 0.95 to account for wastage and you have 0.3343. This means each case if treated is 33.43% more likely to actually be malaria. Thus practically doubling the value

³ Adherence, efficacy taken from literature review; proportion of cases fever taken from World Malaria Report 2008

⁴ DCP2, Table 3B.7: Deaths by Cause, Sex and Age in the Sub Sahara Africa Region, 2001.

⁵ Mean morbidity and mortality rates taken from World Malaria Report 2008.

⁶ 1.8 years is mean age of death, which was derived from a model using multiple DHS datasets (www.measureDHS.org).

of a PPT used on a case of unconfirmed malaria. This raises the value of the 1000 PPT in our example to 131 DALY.

So in this example the incremental benefit of pre-testing 1000 PPT with 1000 RDK is **63** DALY.