Parameters

	Symbol	Description	Value	Source
Population demographics	N_0	Population size	1,000,000	[1]
	M	Birth rate = death rate	25.2/1000/year	[2]
Prevalence of malaria in population	p_{inf}	Mean proportion of population with Plasmodium falciparum parasites in peripheral blood at baseline	0.0 - <u>0.15</u> – 0.7	[3-7], expert opinion
	$sens_{Dx}$	Sensitivity of diagnostic test used to detect parasites in peripheral blood in field conditions	0.8	Expert opinion
	p_a	Proportion of malaria infections that are resistant to artesunate in 2013	0.0-<u>0.1</u>-0.5	Expert opinion
	p_b	Proportion of malaria infections that are resistant to atovaquone in 2013	<u>0.0</u>	Expert opinion
Natural history of malaria infection	Δ	Recovery rate from untreated infectious blood stage infection (nonimmune)	1/200 - <u>1/60</u> $days^{-1}$	[8-13]
	δ_R	Recovery rate from untreated infection (immune)	1/200 - <u>1/30</u> $days^{-1}$	[8-13]

	Γ	Rate of liver stage becoming blood stage	1/5 $days^{-1}$	[8-10]
	Σ	Rate of blood stage becoming gametocytes	1/15 $days^{-1}$	[14, 15]
	Amp	Amplitude of seasonal variation of transmission	0.34	Fitting
	Phi	Peak of seasonal variation of transmission	0.61	Fitting
	Ω	Duration of immunity to malaria	1 years	[16]
	$propRx_R$	Proportion of infected cases with immunity who are treated	0.1	[16]
	$propRx_N$	Proportion of infected cases without immunity who are treated	0.9	[16]
	para_sym:asym	the relative median parasite burdens in symptomatic vs asymptomatic individuals	100,000:1, 1:1000, 1:1	Expert opinion
Artemisinin monotherapy	$start_a$	Year of introduction of artemisinin monotherapy	1975	Expert opinion
	$\tau = \tau_{ai1} = \tau_{ai2}$	Rate of starting artemisinin monotherapy	1/16 infected people per day	[17]

	$propRx_{am}$	Proportion of infected population who receive antimalarials	0.63	[17]
	$prop_a$	Proportion of antimalarials constituting artemisinin monotherapy	0.4	[17]
	adh_a	Proportion of infected population that take full 7 day course of artemisinin monotherapy	0.2	[17]
ACT treatment	$start_{ab}$	Year of introduction of ACT	2000	[18]
	$prop_{ab}$	Proportion of antimalarials constituting ACT	0.72	[19]
	adh_{ab}	Adherence to 3 day course of ACT	0.77-<u>0.92</u>-1.0	[17, 20-22]
	$start_{ab2}$	Year coverage with ACT treatment increased	2014	Expert opinion
	$\tau_{ab} = \tau_{ab1} = \tau_{ab2}$	Rate of reaching maximum coverage with ACT treatment	1/14 $days^{-1}$	[17]
	cov_{ab}	Maximum coverage with ACT for symptomatic cases	0.95	Expert opinion
	$propRx_{ab2}$	Proportion of infected population that take effective ACT after coverage increased	0.87	$= cov_{ab} * adh_{ab}$

Atovaquone-proguanil treatment	$start_{vg}$	Year of introduction of atovaquone-proguanil in place of ACT	2014	Expert opinion
	$prop_{vg}$	Proportion of antimalarials constituting atovaquone-proguanil following its' adoption instead of ACT for treatment of symptomatic cases	0.72	= $prop_{ab}$
	cov_{vg}	Maximum coverage with atovaquone-proguanil for treatment of symptomatic cases	0.95	= cov_{ab}
Mass drug administration	τ_{MDA1} = τ_{MDA2}	Rate of reaching maximum coverage with MDA	1/14 $days^{-1}$	Expert opinion
	cov_{MDA1}	Coverage of first MDA	0.8 - <u>0.95</u>	Expert opinion
	cov_{MDA2}	Coverage of second MDA	0.8 - <u>0.95</u>	Expert opinion
	T_{MDA2}	Time between first and second rounds of MDA	30 - 365 days	Expert opinion
	$dur_{i1} = dur_{i2}$	Duration of single round of MDA	14 days	Expert opinion
	adh_{vg}	Adherence to 3 day course of atovaquone-proguanil	0.88-<u>0.92</u>-1.0	[23-25]

	$propRx_{i1}$ = $propRx_{i2}$	Proportion that receive full 3 day course of MDA	0.87	= cov_{MDA1}*adh_{ab} or cov_{MDA2}*adh_{vg}
Duration of efficacy against sensitive parasites (X)	X_{ao}	Full course of artemisinin monotherapy	7 days	[26, 27]
	X_{ai}	Artemisinin as part of ACT (3 day course)	3 days	[26]
	X_b	Piperaquine	20 days	[28]
	Xg	Proguanil as part of atovaquone-proguanil	4 days	[29]
	Xv	Atovaquone	15 days	[30]
Rates of clearance of drug sensitive infection (ν) by treatment	c_{Broda}	Artemisinin vs non-infectious blood stage	1/7 $days^{-1}$	[31]
	c_{Iroda}	Artemisinin vs infectious blood stage	1/4$days^{-1}$	[32]
	C_{Irodab}, C_{Brodab}	Artemether-piperaquine vs infectious or non-infectious blood stage	1/3 $days^{-1}$	[31, 33, 34]

	c_{Brodb}	Piperaquine vs non-infectious blood stage	1/3 $days^{-1}$	[35]
	c_{Irodb}	Piperaquine vs infectious blood stage	1/21 $days^{-1}$	[33]
	c_{Lrodvg}	Atovaquone-proguanil vs liver stage	1/3 $days^{-1}$	[36]
	c_{Brodvg}	Atovaquone-proguanil vs non-infectious blood stage	1/3 $days^{-1}$	[30]
	c_{Irodvg}	Atovaquone-proguanil vs infectious blood stage	1/(4.5) $days^{-1}$	Unpublished data from Lee S
	c_{Lrodv}	Atovaquone vs liver stage	1/6 $days^{-1}$	[36]
	c_{Brodv}	Atovaquone vs non-infectious blood stage	1/3 $days^{-1}$	[30]
	c_{Irodv}	Atovaquone vs infectious blood stage	1/(4.5) $days^{-1}$	Unpublished data from Lee S
Drug resistance	P_{ra}	Proportion of infections that are resistant to artesunate at the time of first MDA	0.0-0.1-0.5	Expert opinion
	P_{rv}	Proportion of infections that are resistant to atovaquone	0.0	Expert opinion
	pct_{roda}	Parasite clearance time for artemisinin vs sensitive infections	30 hours	[37]

	pct_{rada}	Parasite clearance time for artemisinin vs resistant infections	83 hours	[37]
	ε_{rada}	Relative effectiveness of artemisinin against artemisinin resistant parasites	0.27	= pct_{roda}/pct_{rada} *(1-p_{recra})
	ε_{rbdb}	Relative effectiveness of piperaquine against resistant parasites	0.8	[35]
	ε_{rbdv}	Relative effectiveness of atovaquone against resistant parasites	0.01	[38]
	p_{rvdvg}	Proportion of infections treated with atovaquone-proguanil that develop atovaquone resistance	0.3	[38-40]
	acq_{rvdvg}	Rate of atovaquone resistance arising during treatment with atovaquone-proguanil	1/1000, <u>1/365</u>, 1/10 $days^{-1}$	[38, 40]
	acq_{rvdv}	Rate of atovaquone resistance arising during treatment with atovaquone	1/10, <u>1/1</u>, 1/0.5 $days^{-1}$	Varied to give $p_{rvdvg=0.3}$ as a model output
	$cost_{ra}$	Fitness cost of artemisinin resistance	0.0	[41]
	$cost_{rv}$	Fitness cost of atovaquone resistance	0.05	[42]
Bed nets	ρ	Degree of transmission reduction (the product of coverage and efficacy)	0.3	[43, 44]

tau_{bn}	Time to introduce bed nets	1 month	Expert opinion
cov_{bn}	Coverage with insecticide treated bed nets	0 or 0.75	Expert opinion
dur_{bn}	Duration of effectiveness of bed nets	2 years	Expert opinion

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