Additional file 1. Studies on the interactions between worms and malaria in Humans.

Study site date	Age group	Design & Sample size	Worm species	Malaria	Remarks
Comoro Islands [1] **1977**	Children 0-14	Cross sectional & ecological 869	*Ascaris lumbricoides*	Decreased prevalence/incidence	It is not clear if prevalence or incidence is considered The comparison is not with absence of *Ascaris* but between high burden and low burden
Comoro Islands[2] **1978**	Children 2-14	Randomized controlled trial 122	*Ascaris lumbricoides*	Increased 'incidence' between 6-14 days after piperazine treatment	Given the short interval, malaria was probably present but asymptomatic before piperazine
Thailand **[3]** **2000**	Adults	Case control 537	*Ascaris lumbricoides*	Protection from cerebral malaria Renal failure Pulmonary edema	Dose dependent protection Protection increases with the number of GI species involved
Thailand[28] **2001**	Adults	Case control 179	pooled	Protection from renal failure Protection from jaundice	Linear trend between egg count and odds of renal failure Fewer mature schizonts in GI nematode-infected patients

Thailand **[33]** **2001**	Adults	Cross sectional 200	hookworm	Decreased admission temperature	
Thailand **[49]** **2001**	Adults	Cross sectional 291	Pooled (excluding hookworm)	Increased anemia	
Thailand **[36]** **2001**	Adults	Cross sectional 928	*Ascaris lumbricoides*	More mixed Pf-PV infections	
Thailand **[22]** **2002**	Adults	Cohort 731	Pooled	Increased incidence	Incidence tends (P=0.07) to increase with the number of worm species Mostly hookworm (57%) significant linear trend between incidence and hookworm egg burden
Thailand **[27]** **2002**	Adults	Case control 384	pooled	Protection from cerebral malaria	*Ascaris* only individual species significantly associated with protection (AOR=0.15) Controlling for body mass index
Thailand **[34]** **2002**	Adults	Cross sectional 307	pooled	Increased gametocyte carriage	Association is confounded by lower hemoglobin counts Linear trend between egg count and odds of gametocyte carriage

Senegal **[23]** **2003**	Children 1-14	Cohort 80	pooled	Increased incidence	
Thailand **[35]** **2003**	Adults	Cross sectional 248	*Trichuris trichiura*	Increased multiplicity of infection	
Senegal **[16]** **2004**	Children	Case control 128	*Ascaris lumbricoides*	Increased severe malaria	Case definition includes vomiting (exposure can cause vomiting=>bias) Case classification not performed by physician (39% of the severe malaria diagnoses in fact not malaria) Controls do not have malaria
Senegal **[30]** **2004**	Children	Cohort 512	*Schistosoma mansoni*	Increased *falciparum* malaria incidence	No linear trend between egg burden and malaria but heavy worm burdens had highest malaria incidence
Senegal **[32]** **2004**	Children 7-15& adults>30	Cross sectional 79 children + 49 adults	*Schistosoma haematobium*	No difference in parasitaemia	NB. Patients with clinical mild or severe malaria excluded
Thailand	Adults	Cross sectional	*Ascaris lumbricoides*	Negative correlation between proportion of fertilized *Ascaris* eggs and admission	

[37] **2005**		119		temperature in *vivax* malaria	
Uganda **[4]** **2005**	Children+ Adults	Cross sectional 856	Pooled +individually	No association	
Senegal **[26]** **2005**	Children	Longitudinal 523	*Schistosoma haematobium* *GI nematodes* (pooled)	Decreased parasitaemia	Association with decreased parasitaemia observed in low egg burdens Non significant trend for negative association For GI nematodes & malaria no association with parasite densities. Pooled but mainly *Ascaris*.
Mali **[31]** **2005**	Children (4-14)	Cohort 676	*Schistosoma haematobium*	Decreased incidence of *clinical* malaria	IL-6 and IL-10 levels blunted by *S. haematobium* [50]
Madagascar **[6] 2006**	Children	Randomized controlled trial 350	*Ascaris*	Increased *falciparum* parasitaemia after levamisole treatment of *Ascaris* in children> 5 years	No apparent effect before 5 years of age
Madagascar **[7]2007**	Children	Randomized controlled trial 212	*Ascaris*	Increased *falciparum* parasitaemia after levamisole treatment of *Ascaris* in children> 5 years	No apparent effect before 5 years of age

Kenya [14] **2008**	Children	Cohort 387	Pooled	No increased incidence	
Uganda **[19]** **2008**	Pregnant women	Cross sectional 2507	Hookworm	Increased malaria prevalence	*Mansonella perstans* associated with hookworm and malaria
Zimbabwe **[20]** **2008**	Children	Cross sectional 1303	Hookworm	Increased *falciparum* malaria prevalence	*S. mansoni* also associated with increased *falciparum* malaria prevalence
Kenya **[8]** **2009**	Pregnant women	Cross sectional 390	*Ascaris lumbricoides*	Lower malaria prevalence	Gravida 2 & 3
Ethiopia **[9]** **2009**	Children & adults	Cross sectional 458	Hookworm *Ascaris lumbricoides* Pooled	Intensity of hookworm infection correlates with malaria parasitaemia Lower malaria parasitaemia in *Ascaris* heavy infections Less severe malaria in helminth- infected persons	
Zanzibar **[25]**	Children 6-23 months	Cross sectional+Case control	Pooled and individual nematodes	Less malaria in nematode-infected children	Nematode-infected children had higher hemoglobin concentration and mid-upper arm circumference than children without nematodes

2009		2322 + 690			
Ghana **[12]** **2010**	Pregnant women	Cross sectional 746	Pooled & individual nematodes	Increased malaria prevalence in hookworm-infected women & *Ascaris*-infected women	
Senegal **[43]** **2010**	Children 1-14	Cohort 203	pooled	Increased malaria incidence	Mostly hookworm (43%) Then *Ascaris* (10 %)
Brazil **[10]** **2010**	Children 5-14	Cohort 216	*Ascaris lumbricoides* *Trichuris trichiura* hookworm	Lower drop in haematocrit during *vivax* malaria in patients with *Ascaris*, *trichuris*, or hookworm	
Thailand **[11]** **2010**	Pregnant women	Cross sectional 829	hookworm *Ascaris lumbricoides*	Increased malaria (*vivax* & *falciparum*) in hookworm-infected women Decreased malaria (*vivax* & *falciparum*) in *Ascaris*-infected women	
Nigeria **[24]** **2010**	Children 12-59 months	Randomized control trial 320	All worms	Decreased malaria prevalence on 4-monthly screenings in patients receiving albendazole Non significant trend to have higher parasitaemia in the placebo group Non significant increase in haemoglobin concentration in children receiving	Authors conclude that parasite clearance and immunity may be delayed. *Ascaris* singled out but other helminths also treated by albendazole. Increased incidence and role of hemoglobin concentration not discussed.

				albendazole	
Gabon **[13]** **2010**	Pregnant women	Longitudinal survey 388	All worms	*Ascaris* associated with increased malaria incidence	Not clear if *Ascaris*-infected women were treated before malaria
Global **2010**	Country prevalences for different geohelminths Malaria incidence data for each country	Classification regression analysis trees/ / Ecological data from 108 countries	*Ascaris lumbricoides* hookworm	*Ascaris* negatively associated with malaria incidence (10 fold reduction) Hookworm associated with increased malaria	Ecological data regression analysis trees. Hookworm effect not observed in multivariable analysis
Uganda **[21]** **2011**	Children & adults	Cross sectional	hookworm	Positive association between Plasmodium and hookworm among preschool-aged children and adults, but not school -aged children. Spatial and household clustering of coinfections.	Link between malaria and other gastrointestinal nematodes not reported in the study. Study controlled for socioeconomic and microgeographic factors.