THE LANCET Global Health

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement

Contents

Supplement S1: Study quality assessment

Quality assessment

Assessment of these surveys was based on source population, participant selection, completeness of outcome data, and measures to control confounding, after reviewing literature on quality assessment of observational studies.[1,2] Scores were not assigned, but quality was assigned as low-to-moderate or good. A study was deemed to be good if there was an appropriate source population and participant selection (in this case, pregnant women and children selected from the same location at about the same study period), an appropriate malaria test, no missing outcome data, and a description of characteristics of the study population(s), in particular age. Multivariate analysis was not included as a quality criterion because for almost all studies the comparison of malaria in children *versus* pregnant women was not the focus of the manuscript. Outcome was considered 'adequate' if more than 80% of participants initially enrolled were included in the analysis, 'unclear' if the percentage of initially enrolled participants included in the analysis was unclear, and 'inadequate' if less than 80% of those initially enrolled were included in the analysis.

Table S1: **Quality assessment of 18 sources included in the comparison of malaria in pregnant women *versus* children 0-59 months, sub-Saharan Africa, 1983-2012**

●: Adequate or appropriate. ○: Unclear from available information. ▲: Inappropriate or inadaequate reported

Author/year, type of material	Study source population described and adequate	Inclusion/exclusion criteria described and adequate for study purpose	Tests described, appropriate	Incomplete outcome data	Characteristics reported	Other bias and notes	Assessment quality for review
Angola MIS 2006-7[3] Report	Community, both	Yes In random households selected from random clusters for the survey	Yes, rapid diagnostic malaria test	Children 9% missing, PW 0%	Yes, SES, area of residence, education, but not gravidity or age for PW	None detected	Good
	●	●	●	●	●	●	
Côte d'Ivoire DHS 2011-12[4] Report	Community, both	Yes In random households selected from random clusters for the survey	Yes, microscopy	Children 13% PW 21%	Yes, SES, area of residence, education, but not gravidity or age for PW	None detected	Good
	●	●	●	●	●	●	
Deribew 2010[5] Article	Community, both	Yes In villages in study area	Yes, microscopy	Children 12%, NR for PW	Yes, for both	None detected	Low-to-moderate
	●	●	●	▲	●	●	
Dicko 2003, 2005[6,7] Article	Yes, both from community	Yes, from villages randomly selected	Yes, microscopy	Not reported	Characteristics partly presented (age only for children)	None detected	Low-to-moderate
	●	●	●	▲	●	●	
Equatorial Guinea MIS Bioko 2008-9[8] Report	Community, both	Yes In random households selected from random clusters for the survey	Yes, rapid diagnostic malaria test	Not reported	Children: yes PW: none	None detected	Low-to-moderate
	●	●	●	▲	●	●	
Graves 2009[9] Article	Community, both	Yes In random households selected from random clusters for the survey	Yes, microscopy	Not reported	Not reported	Considerable *P. vivax*	Low-to-moderate
	●	●	●	▲	▲	▲	
Mabunda 2006[10] Thesis	Yes, both from community	Yes, from villages randomly selected	Yes, microscopy	Not reported	Yes, age and parity reported for PW	Conducted over two malaria seasons	Low-to-moderate
		●	●	▲	●	▲	
Matola 1985[11] Article	MCH and ANC clinics of the same two health facilities	Not reported	Yes, microscopy	Not reported	PW: mean age and parity reported. Children: mean age reported	None	Low-to-moderate
	●	▲	●	▲	●	●	
McElroy/Bloland 1999[12,13] Article	Community, both	Yes, in study cohort	Yes, microscopy	Not reported	Yes	None detected	Low-to-moderate
	●	●	●	▲	●	●	

| Author/year, type of material	Study source population described and adequate	Inclusion/exclusion criteria described and adequate for study purpose	Tests described, appropriate	Incomplete outcome data	Characteristics reported	Other bias and notes	Assessment quality for review
Mozambique MIS 2007[14] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, microscopy ●	Not reported ▲	Yes, SES, area of residence, education, but no gravidity, age for PW ●	None detected ●	Low-to-moderate
Namibia MIS 2009[15] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, rapid diagnostic malaria test ●	5% for children, 2% for pregnant women ●	No ▲	None detected ●	Low-to-moderate
Nyan 2009[16] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, rapid diagnostic malaria test ●	Not reported ▲	Yes, for both ●	None detected ●	Low-to-moderate
Rehman 2013[17] Article	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, rapid diagnostic malaria test ●	Children 7% PW 42% ▲	Children: age PW: none ▲	None detected ●	Low-to-moderate
Rwanda DHS 2007-8[18] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, microscopy ●	Children 14% PW 5% ●	Yes, SES, area of residence, education, but no gravidity, age for PW ●	None detected ●	Good
Rwanda DHS 2010-11[19] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, microscopy ●	Not reported ▲	Yes, SES, area of residence, education, but no gravidity, age for PW ●	None detected ●	Low-to-moderate
South Sudan MIS 2009[20] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, rapid diagnostic malaria test ●	Children 3% PW 17% ●	Yes, SES, area of residence, education, age but no gravidity for PW ●	None detected ●	Good
Sudan MIS 2005[21] Report	Community, both ●	Yes In random households selected from random clusters for the survey ●	Yes, microscopy ●	Overall blood samples 7% missing ●	Yes, area of residence but no other characteristics ●	None detected ●	Good
Van Eijk 2008[22] Article	Yes, both from community	Yes, random selection for children, all pregnancies for PW in study area	Yes, microscopy	Children and PW <1%	Characteristics present for both	None detected	Good

Author/year, type of material	Study source population described and adequate	Inclusion/exclusion criteria described and adequate for study purpose	Tests described, appropriate	Incomplete outcome data	Characteristics reported	Other bias and notes	Assessment quality for review
	🟢	🟢	🟢	🟢	🟢	🟢	

Abbreviations (in alphabetical order): ANC: antenatal clinic, DHS: Demographic and Health survey, MCH: Mother and Child Health Clinic, MIS: malaria indicator survey, NR: Not reported, PW: pregnant women, SES: socio-economic status

Supplement S2: Insecticide treated net us by pregnant women and children

Figure S2: **Scatterplot of use of insecticide nets (%) by pregnant women and children <5 years of age among surveys included in this review, sub Saharan Africa, 2002-2012**
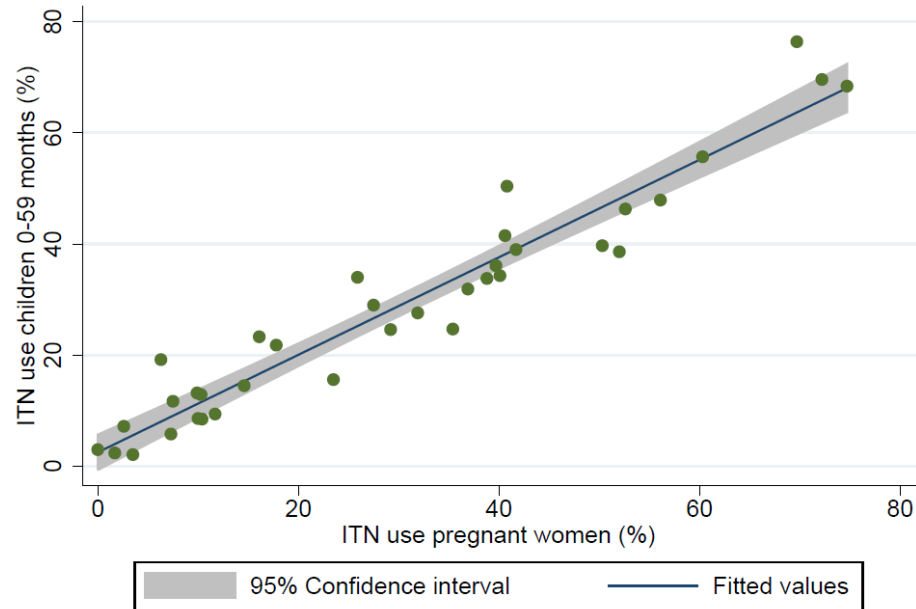
ITN: Insecticide treated net; ITN use defined as use of an insecticide treated net the night before the survey

Pearson correlation coefficient 0·96

Supplement S3: Sources used for an HIV estimate

Estimate HIV

If the malaria information was retrieved from a Demographic and Health survey (DHS) or an AIDS Indicator Survey (AIS) where HIV testing was conducted, results for HIV were obtained from the same report for women aged 15-49 years. If another source was used, results for HIV were obtained from a DHS or AIS report close in date (within 5 years). If this was not available, HIV estimates for the age group 15-49 years of age were obtained for the year involved from Index mundi and these were multiplied by 1·2 to obtain the estimate among women aged 15-49 years.[23] The multiplication factor was obtained after comparing HIV prevalence by gender in 47 African DHS reports with information on the overall HIV prevalence. For Mozambique, the prevalence by region (North, Central and South) was proportionally adjusted using the distribution of HIV among women reported in the AIS of 2009.[10,24] A study in Tanzania conducted at the start of the HIV-epidemic was assigned an arbitrary value of 0·5%.[11] In Kenya, women in Nyanza province were 2·6 times more likely to have HIV compared to the national estimate (both men and women), and this was taken into account for the HIV estimate for Kenya in 1992-1996.[13,25]

Figure S3: **Scatterplot of HIV prevalence among women aged 15-49 years (%) versus persons aged 15-49 years (%) (both genders) among 47 national surveys conducted between 2001 and 2014 in sub Saharan Africa**
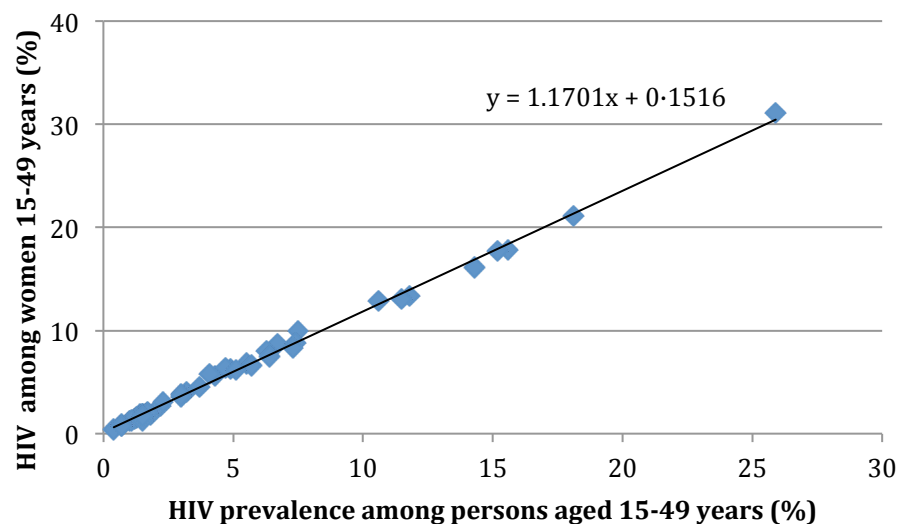
Supplement S4: Metaregression of the prevalence ratio of malaria among children 0-59 months *versus* pregnant women by gravidity

Table S4a: **Meta-regression of factors potentially affecting the prevalence ratio of malaria among children 0-59 months of age *versus* primigravidae, sub-Saharan Africa, 1983-2012**

| Covariate | Univariate analysis | | | | | | | | | |
	Type of covariate	No. of surveys†	Pooled prevalence ratio by subgroup	I^2 and 95% CI for subgroup analysis (%)	Odds ratio meta-regression	95% CI	p-value by level	τ^2	Variance explained (%)	p-value overall
No covariates		8						0·010		
(Sub)national survey	Yes	4	1·17, 1·04-1·32	0, 0-85	1·01	0·75-1·37	0·939	0·014	0·0	0·939
	No	4	1·15, 0·97-1·37	76, 33-91	1·00	Reference				
Place of recruitment pregnant women	ANC	1	0·90, 0·70-1·17		0·76	0·51-1·12	0·130	0·006	40·0	0·130
	Community	7	1·20, 1·08-1·32	36, 0-73	1·00	Reference				
Malaria test	RDT	1	0·94, 0·62-1·40		0·79	0·44-1·42	0·368	0·010	0·0	0·368
	BS	7	1·18, 1·05-1·31	53, 0-80	1·00	Reference				
Time period	2000+	5	1·16, 1·05-1·29	0, 0-79	1·00	Reference	0·964	0·015	0·0	0·964
	<2000	3	1·15, 0·90-1·47	84, 53-95	0·99	0·74-1·34				
Malaria transmission intensity*	Continuous	8			0·99	0·99-1·01	0·582	0·011	0·0	0·582
	>40%	5	1·16, 0·92-1·47	66, 12-87	0·99	0·68-1·46	0·992	0·012	0·0	0·992
	5-40%	3	1·16, 1·02-1·32	0, 0-90	1·00	Reference				
Antimalarial regimen during pregnancy	None	2	1·13, 1·04-1·23		1·00	Reference		0·020	0·0	0·971
	IPTp	4	1·16, 0·99-1·35	0, 0-85	1·02	0·68-1·52	0·915			
	Prophylaxis†	2	1·15, 0·72-1·86		1·04	0·68-1·59	0·819			
ITN use during Pregnancy	No ITN information	5	1·16, 1·02-1·32	66, 12-87	1·00	Reference		0·013	0·0	0·807
	ITN use < 25%	2	1·11, 0·83-1·48		0·95	0·60-1·51	0·790			
	ITN use ≥25%	1	1·39, 0·82-2·38		1·20	0·53-2·71	0·585			
Age definition of child group	0-59 months	4	1·11, 1·03-1·20	7, 0-86	1·00	Reference		0·0	100·0	0·096
	6-59 months	3	1·16, 0·92-1·47	0, 0-90	1·04	0·75-1·45	0·751			
	Other	1	1·45, 1·22-1·71		1·30	1·02-1·66	0·039			
Estimate maternal HIV infection (%)	Continuous	8			1·00	0·98-1·01	0·861	0·014	0·0	0·861
	>9%	4	1·14, 1·06-1·23	0, 0-85	0·99	0·73-1·33	0·939	0·014	0·0	0·939
	<= 9%	4	1·14, 0·85-1·54	74, 27-91	1·00	Reference				
Quality survey	Good	5	1·17, 1·02-1·35	67, 15-87	1·04	0·74-1·45	0·792	0·013	0·0	0·792
	Low to moderate	3	1·13, 0·95-1·35	0, 0-90	1·00	Reference				

Abbreviations: ANC: antenatal clinic, CI: confidence interval, ITN: insecticide treated net, RDT: rapid diagnostic malaria test, SP: sulfadoxine-pyrimethamine

Note: None of the factors with a p-value <0·2 (age definition of child, place of recruitment or maternal HIV infection) was significant in multivariate analysis

* Average malaria transmission: average of child and maternal malaria

†Any dose for any time period of prophylaxis, i.e. not IPTp regimen

Table S4b: **Meta-regression of factors potentially affecting the prevalence ratio of malaria among children 0-59 months of age *versus* multigravidae, 7 studies, sub-Saharan Africa, 1983-2012**

Covariate	Type of covariate	No. of surveys†	Pooled prevalence ratio by subgroup	I^2 and 95% CI for subgroup analysis (%)	Odds ratio meta-regression	95% CI	p-value by level	τ^2	Variance explained (%)	p-value overall
	Univariate analysis									
No covariates		7	1·94, 1·68-2·24					0·032		
(Sub)national survey	Yes	4	2·12, 1·56-2·88	80, 46-92	1·13	0·68-1·88	0·567	0·047	0·0	0·567
	No	3	1·86, 1·53-2·27	82, 46-94	1·00	Reference				
Place of recruitment pregnant women	ANC	1	1·54, 1·22-1·94		0·76	0·39-1·46	0·328	0·032	1·7	0·328
	Community	6	2·02, 1·72-2·36	81, 60-91	1·00	Reference				
Malaria test	RDT	1	1·68, 1·19-2·38		0·84	0·37-1·90	0·614	0·041	0·0	0·614
	Microscopy	6	1·97, 1·69-2·31	83, 64-92	1·00	Reference				
Time period	2000+	5	1·96, 1·65-2·33	73, 32-89	1·00	Reference	0·744	0·050	0·0	0·744
	<2000	2	1·86, 1·30-2·67	88, 52-97	0·93	0·53-1·63				
Malaria transmission intensity*	Continuous				0·99	0·98-1·01	0·420	0·042	0·0	0·420
	>40%	4	1·81, 1·54-2·12	85, 63-94	0·77	0·48-1·23	0·209	0·025	21·1	0·209
	5-40%	3	2·38, 1·63-3·48	69, 0-91	1·00	Reference				
Antimalarial regimen during pregnancy	None	2	1·91, 1·44-2·54	94, 83-98	1·00	Reference		0·048	0·0	0·567
	IPTp	4	2·16, 1·64-2·85	73, 23-90	1·13	0·61-2·07	0·615			
	Prophylaxis†	1	1·54, 1·22-1·94		0·80	0·34-1·91	0·523			
ITN use during Pregnancy	No ITN information	4	1·81, 1·54-2·12	85, 63-94	1·00	Reference		0·020	37·4	0·202
	ITN use < 25%	2	2·06, 1·40-3·04	63, 0-92	1·15	0·69-1·89	0·495			
	ITN use ≥25%	1	3·41, 2·16-5·38		1·89	0·83-4·26	0·097			
Age definition of child group	0-59 months	4	1·81, 1·54-2·12	85, 63-94	1·00	Reference		0·025	21·1	0·209
	6-59 months	3	2·38, 1·63-3·48	69, 0-91	1·30	0·81-2·08	0·209			
	12-59 months	0								
Estimate maternal HIV infection (%)	Continuous	7			1·01	0·98-1·04	0·651	0·039	0·0	0·651
	>9%	4	1·96, 1·66-2·31	85, 63-94	1·02	0·59-1·78	0·923	0·044	0·0	0·923
	<= 9%	3	2·00, 1·28-3·13	81, 42-94	1·00	Reference				
Quality survey	Good	4	1·91, 1·56-2·34	87, 68-95	0·93	0·54-1·60	0·754	0·047	0·0	0·754
	Low to moderate	3	2·08, 1·48-2·92	74, 14-92	1·00	Reference				

Abbreviations: ANC: antenatal clinic, CI: confidence interval, IPTp: intermittent preventive treatment in pregnancy, ITN: insecticide treated net, RDT: rapid diagnostic malaria test,
* Average malaria transmission: average of child and maternal malaria
†Any dose for any time period of prophylaxis, not IPTp regimen

Supplement S5: Antenatal clinic attendance in malarious countries in sub-Saharan Africa by setting, 2008-2014

Table S5: **Antenatal clinic attendance and timing of first antenatal visit in national surveys in malarious countries by setting and malaria prevalence among children, sub-Saharan Africa, 2008-2014**

Country	Survey	At least one antenatal visit, %			Start of 1st visit before 6 months, %			Survey	Malaria prevalence in survey among children months, %				
		All	Urban	Rural	All	Urban	Rural		Test	Age*	All	Urban	Rural
Angola	NA							MIS 2011	Mx	6-59	10·1	1·4	14·0
Benin	DHS 2011-12	85·8	91·3	82·1	75·6	79·6	72·8	DHS 2011-12	Mx	6-59	28·4	20·8	33·2
Burkina Faso	DHS 2010	94·9	98·3	94·1	80·2	87·1	78·6	DHS 2010	Mx	6-59	65·9	29·8	72·9
Burundi	DHS 2010	98·9	99·0	98·9	64·7	80·4	63·2	DHS 2010	ND				
Cameroon	DHS 2011	84·7	95·6	75·6	69·9	82·5	59·4	DHS 2011	RDT	6-59	30·0	20·6	37·1
CAR	MICS 2010	68·2	88·3	57·4	NA				NA				
Chad	MICS 2010	53·2	78·3	45·7	NA				NA				
Republic of Congo	DHS 2011-12	92·6	95·9	86·8	84·5	88·7	76·8	DHS 2011-12	ND				
DR Congo	DHS 2013-14	88·4	94·1	85·8	57·7	68·0	52·9	DHS 2013-14	Mx	6-59	22·6	19·6	23·9
Côte d'Ivoire	DHS 2011-12	90·6	96·7	86·5	64·3	77·2	55·9	DHS 2011-12	MX	6-59	18·0	7·4	24·1
Equatorial Guinea	DHS 2011	91·3	93·3	89·4	87·4	90·0	84·9	DHS 2011	RDT	6-59	47·8	29·9	62·6
Eritrea	DHS 2010	88·5	97·3	84·2	70·7	83·6	64·5		ND				
Ethiopia	DHS 2011	33·9	76·0	26·4	27·7	62·5	21·5		ND				
Gabon	DHS 2012	94·7	96·1	85·7	88·9	90·8	77·5		ND				
The Gambia	DHS 2013	86·2	87·5	84·9	NA			DHS 2013	Mx	6-59	0·8	1·1	0·5
Ghana	MICS 2011	96·4	98·0	95·2	NA			MICS 2011	Mx	6-59	27·5	13·1	38·8
Guinea	DHS 2012	85·2	96·3	80·8	70·8	85·8	64·8	DHS 2012	Mx	6-59	43·9	18·1	52·6
Kenya	DHS 2014	95·5	97·8	94·0	NA			MIS 2010	Mx	6-59	8·2	NA	NA
Liberia	DHS 2013	95·9	98·0	93·4	93·3	90·7	87·5		ND				
Madagascar	DHS 2008-09	86·3	94·7	85·1	69·6	85·4	67·3	MIS 2013	Mx	6-59	9·1	2·9	9·5
Malawi	DHS 2010	94·7	96·2	94·4	60·6	61·7	60·5	MIS 2012	Mx	6-59	27·7	9·4	30·4
Mali	DHS 2012-13	74·2	93·2	69·3	60·7	82·0	55·1	DHS 2012-13	Mx	6-59	51·6	16·8	59·5
Mauritania	MICS 2011	84·2	92·4	78·5	NA				NA				
Mozambique	DHS 2011	90·6	96·3	88·2	60·0	65·6	57·7	DHS 2011	Mx	6-59	35·1	16·2	42·2
Namibia	DHS 2013	96·6	96·7	96·5	80·9	80·7	81·1	DHS 2013	ND				
Niger	DHS 2012	82·8	96·9	80·4	62·0	84·5	58·2	DHS 2012	ND				
Nigeria	DHS 2013	60·6	86·0	46·5	47·5	65·8	37·5	MIS 2010	Mx	6-59	42·0	22·5	47·7
Rwanda	DHS 2010	98·0	98·3	98·0	76·5	78·5	76·3	DHS 2010	Mx	6-59	1·4	0·8	1·4
Sao Tome and Principe	DHS 2008-09	97·9	98·4	97·5	81·7	84·0	79·6		ND				
Senegal	DHS 2014	96·2	99·2	93·8	85·9	91·5	81·3	DHS 2014	Mx	6-59	1·2	0·3	1·9
Sierra Leone	DHS 2013	97·1	98·2	96·7	86·5	86·6	86·4	MIS 2013	Mx	6-59	42·9	28·1	48·0
Somalia	MICS 2011	28·0	38·2	15·3	NA				NA				
South Sudan	MICS 2010	40·3	57·6	34·2	NA				NA				
Sudan	MICS 2010	74·3	84·3	70·4	NA				NA				
Tanzania	DHS 2010	95·9	98·6	95·1	64·8	64·7	66·1	MIS 2011-12	Mx	6-59	4·1	1·0	4·7
Togo	DHS 2013	72·7	96·5	58·4	69·2	80·4	63·3		Mx	6-59	36·4	14·5	47·4
Uganda	DHS 2011	94·9	97·4	94·4	64·7	68·8	63·9	MIS 2009	Mx	0-59	42·4	15·3	47·1
Zambia	DHS 2013-14	95·7	98·6	94·0	79·6	79·3	79·8	MIS 2012	Mx	0-59	14·9	3·7	20·2
Zimbabwe	DHS 2011-12	89·8	89·9	89·8	58·9	54·5	60·9		ND				

Abbreviations: CAR: Central African Republic, DHS: Demographic and Health Survey, DRC: Democratic Republic of the Congo, MICS: Multiple Indicator Cluster Survey, MIS: Malaria Indicator Survey, Mx: microscopy, NA: not available, ND: not done, RDT: rapid diagnostic malaria test

*Age in months

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