

**ADDITIONAL FILE 3**

**SYSTEMATIC REVIEW OF COST-EFFECTIVENESS ANALYSES OF INSECTICE-TREATED BEDNETS AND INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL IN AFRICA**

In order to contextualize the results of this economic evaluation of larviciding for malaria control, cost-effectiveness analyses of indoor residual spraying (IRS) and insecticide-treated bendets (ITN) for malaria control in SSA were systematically reviewed. This review will help examine the methodological issues and assumptions upon which these economic evaluations are based.

**Methodology**

PubMed was queried using the terms described below (Table 1). No time restriction was imposed. The search retrieved 402 publications that were evaluated based on either title alone (n=253) or title and abstract (n=149). The eligibility and exclusion criteria are described in Table 2. A total of 12 articles for IRS and 24 for ITN were selected based on their title and abstract but 5 IRS and 6 ITN studies were excluded after reading the paper (Table 3). Finally, one IRS study was identified through other means and included in the review. Hence, a total of 7 IRS and 18 ITN cost-effectiveness studies were included in the final review.

**Results**

A summary of the reviewed cost-effectiveness studies of IRS is present in Table 4. Cost-effectiveness studies of ITN is presented in Table 5.

**Table 1** PubMed search query information for the systematic review

<p><b>PubMed Search:</b>          (malaria OR falciparum) AND (cost OR cost-effectiveness) AND ((ITN OR bed net* OR bednet* OR net OR long-lasting insecticide-treated net* OR LLIN) OR ((insecticide OR residual house spraying OR indoor residual spraying OR IRS))) AND (Africa)</p>
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**Table 2** Eligibility and exclusion criteria for the systematic review

<b>Eligibility Criteria</b>	<ul style="list-style-type: none"> <li>-Study conducted in Africa.</li> <li>-Study reports cost-effectiveness of IRS or ITN.</li> <li>-Malaria cases, malaria deaths, or DALYs are the health outcomes.</li> </ul>
<b>Exclusion Criteria</b>	<ul style="list-style-type: none"> <li>-Study not relevant to malaria.</li> <li>-Literature review.</li> <li>-Letter to the Editor.</li> <li>-Studies conducted on packages of interventions where we cannot distinguish between IRS, ITN, or any combinations of interventions.</li> <li>-Study is published in a language other than English, French, or Portuguese.</li> </ul>

**Table 3** Studies retrieved, selected, and included in the systematic review

Articles Retrieved (IRS and ITN combined)	402
Articles selected based on title and abstract	IRS = 12 ITN = 24
Final number of articles included in the review	IRS = 7 ITN = 18

**Table 4** Summary of cost-effectiveness analyses of indoor residual spraying interventions conducted in sub-Saharan Africa.

Country	Year of Program	Currency	Age Group	Perspective	Cost PPY	Effect Size	Incidence per 1,000	CER / Infection	CER / Death	CER / DALY	Ref
Low and Middle Income Countries	NA	USD 2001	NA	Provider	NA	50% reduction in incidence; 17% reduction in child mortality	NA	NA	NA	Once a year: Malathion =\$12; DDT =\$9; Deltamethrin =\$10; λ-cyhalothrin =\$10; Twice a year: Malathion =\$24; DDT =\$17; Deltamethrin =\$18; λ-cyhalothrin =\$19	[1]
South Africa and Mozambique	SA =1997-1999; MZ =1999-2001	USD 2005	<5	Provider	SA =\$3.27 and MZ =\$3.90	5.5 child deaths averted per 1,000 child-years	NA	NA	SA =\$4,357; MZ =\$3,933	SA =\$132; MZ =\$119	[2]
SSA	Hypothetical 10 years program	Int 2000	<5	Provider	NA	50% reduction in incidence; 20% reduction in case fatality	<u>Incidence:</u> Afr-D= 1,436; Afr-E= 1,184. <u>Mortality:</u> Afr-D= 7; Afr-E = 8.	NA	NA	Afr-D =\$32; Afr-E =\$41	[3]
Kenya	1999-2000	~USD 2000	0-99	Provider	\$0.88	RR=0.25 (0.24-0.27)	NA	\$9	NA	NA	[4]
SSA (model)	NA	USD 1995	<1	Provider & Community	Once yearly (\$5.76-10.18); Twice yearly (\$11.53-20.36)	52% decrease in all cause mortality	1,500	NA	NA	Once yearly (\$16-29); Twice yearly (\$32-58)	[5]
Mozambique	0	USD 2000	2-15 (parasitaemia) & 0-99 (clinical case)	Provider	\$4.82	11,857 malaria cases averted	NA	\$29.43	0	NA	[6]
Model Area in Africa	1978	~USD 1975	0-99	Gross CER	\$2	40% reduction in crude death rate (adult); 50% reduction in infant mortality	NA	NA	\$250 (all); \$600 (infants)	NA	[7]

**Table 5** Summary of cost-effectiveness analyses for insecticide-treated bednet interventions conducted in sub-Saharan Africa.

Country	Year of Program	Currency	Age Group	Perspective	Cost PPY	Effect Size	Incidence per 1,000	CER / Infection	CER / Death	CER / DALY	Ref
Low and Middle Income Countries	Hypothetical Program	USD 2001	<5	Provider	NA	5.5 child deaths averted per 1,000 child-years	NA	NA	NA	Permethrin = \$17 Deltamethrin = \$11	[1]
Eritrea (ER); Togo (TG); Malawi (MW); Senegal (SG); Tanzania (TZ);	ER=2001-2005; TG=2004; MW=1999-2005; SG=2000-2005; TZ=2002-2005	USD 2005	<5	Provider	Cost per ITN: ER=\$3.98; TG=\$3.32; MW=\$3.36; SG=\$8.05; TZ=\$4.80	50% reduction in incidence; 20% reduction in case fatality	NA	NA	Including re-treatment: ER=\$438; TG=\$1,174; MW=\$1,105; SG=\$2,199; TZ=\$788.	Including re-treatment: ER=\$13; TG=\$36; MW=\$33; SG=\$67; TZ=\$24.	[2]
SSA	Hypothetical 10 years program	INT 2000	<5	Provider	NA	RR=0.25 (0.24-0.27)	Incidence: Afr-D=1,436; Afr-E=1,184. Mortality: Afr-D=7; Afr-E=8.	NA	NA	Afr-D = \$29 Afr-E = \$41	[3]
Kenya	1999-2000	~USD 2000	0-99	Provider	\$2.02-2.34	19% decrease in all cause mortality; 46% decrease in malaria-related morbidity	NA	\$29	NA	NA	[4]
SSA (model)	NA	USD 1995	<5	Provider & Community	Not mentioned	0.69 (ITN vs IRS)	1500	NA	NA	Bednet only: \$19-85; Bednet and insecticide: \$25-96	[5]

Country	Year of Program	Currency	Age Group	Perspective	Cost PPY	Effect Size	Incidence per 1,000	CER / Infection	CER / Death	CER / DALY	Ref
South Africa (KwaZulu-Natal)	1998-1999 (Comparison ITN vs IRS)	USD 1999	All	Provider	7.62	HR for infant mortality of 0.78	253 (174.5 /0.69)	16	\$1,696	NA	[8]
Democratic Republic of the Congo	2005-2006 (Comparison ITN vs diagnosis / treatment, IPTp, / ANC services)	USD 2005	Pregnant women	Provider	Not mentioned	Reduction in all-cause mortality of 17% among U5	Used an infant mortality rate of 95/1,000	NA	\$411.13	\$17.22	[9]
Togo	2004-2005	USD 2004	<5	Provider	\$5.95 (per LLIN distributed)	Reduction in incidence of 50% and 5.5 deaths averted per 1,000	1,209	4.4	\$856	\$22.1	[10]
United Republic of Tanzania	2004-2006	USD 2006	<5	Provider	\$7.57 (per ITN delivered)	PE=27%	Incidence of malaria outpatient in U5 is 723/1,000	NA	\$873	NA	[11]
United Republic of Tanzania	1996-2000	USD 2000	<5	Provider	\$13.38 per treated-net year	NA (73 deaths averted)	Infant mortality =73; Child mortality =15	NA	\$1,559	\$57	[12]
Kenya	1997-1999	USD 1996	<5	Provider & Community	\$1.40 (\$1.90 per ITN)	Reduction in incidence of 46%; reduction in all cause mortality of 19%	NA	NA	\$1,214	\$49	[13]
Sub-Saharan Population	Not mentioned	USD 1995	1-119 months	Provider	3.79	Not mentioned	U5 =1,500; 5-10 =555	NA	NA	No rebound = \$44	[14]

Country	Year of Program	Currency	Age Group	Perspective	Cost PPY	Effect Size	Incidence per 1,000	CER / Infection	CER / Death	CER / DALY	Ref
Guinea	Not mentioned	USD 1994	<5	Provider	3	50% reduction in incidence; 35% reduction in all-cause mortality	Mortality =14	NA	NA	\$43	[15]
The Gambia	1990-1995	USD 1990	The cohort of children born in 1990 and followed for 5 years	Provider	NA	Estimated from 10 villages	1-6 months =200; 6-12 months =800; 1-5 years =1,000	NA	\$711	NA	[16]
The Gambia	1991-1992	USD 1992	<10	Provider & Community	NA	U5 mortality reduced by 17%	440	NA	\$471	\$31.5	[17]
Ghana	1993-1994	USD 1994	<5	Provider & Community	\$1.2 per child-year (\$2.4 per bednet)	All-cause mortality reduced by 25% in U5.	NA	NA	\$2,003	\$73.5	[18]
West Africa	5 years of follow-up	~USD 1996	Cohort of new-born	Provider	Not mentioned	60% decrease in mortality in the 1-4 years old; 45% decrease in clinical episodes	Not mentioned	NA	NA	100% compliance = \$18.88; 50% compliance = \$38.04	[19]
The Gambia	1989-1990	USD 1990	1-4 years of age	Provider & Community	\$5.65 per child-year	0	Not mentioned	NA	\$187.53	\$7.9	[20]

ANC = antenatal care; INT = international dollar; IPTp = intermittent treatment for malaria in pregnancy; ITN = insecticide treated nets; IRS = indoor residual spraying; LLIN = long-lasting insecticide-treated nets; NA = not applicable; U5 = under five years of age; USD = United States dollar.

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