

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies [ordered by study ID]

#### Balfour 1936 GRC

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Town and rural areas</p> <p><b>Cluster size:</b> Population of towns: 1700; 1130; 830; 32,200; 31,550 individuals</p> <p><b>Number of clusters in each arm:</b> Intervention arm: two; control arm: three</p> <p><b>Adjusted for clustering?</b> No</p>	
Participants	<p><b>Age:</b> School children</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Parasite prevalence):</b> 210, 112, 97, 853, 650 participants per survey</p> <p><b>Secondary outcome sample size (Spleno-megaly prevalence):</b> 210, 112, 97, 853, 650 participants per survey</p>	
Interventions	<p><b>Intervention:</b> Habitat modification with larviciding</p> <p><b>Details of the intervention:</b></p> <p><b>Habitat modification:</b> Drainage and reclamation of marshland, straightening of rivers and construction of embankments</p> <p><b>Larviciding:</b> Larval habitats were treated with Paris Green (dosage not stated)</p> <p><b>Frequency of application:</b> Not stated</p> <p><b>Duration of intervention period:</b> 60 months</p> <p><b>Who was responsible for LSM?</b> The government</p> <p><b>Co-interventions:</b> Case management: treatment with quinine (coverage not stated)</p> <p><b>Co-interventions equal in each arm?</b> Not stated</p>	
Outcomes	<p>1. <b>Parasite prevalence</b> (measured with yearly cross-sectional surveys)</p> <p>2. <b>Spleno-megaly prevalence</b> (measured with yearly cross-sectional surveys)</p>	
Notes	<p><b>Continent:</b> Europe</p> <p><b>Country:</b> Greece</p> <p><b>Ecosystem:</b> Coastal</p> <p><b>Urban or rural:</b> Urban and rural</p> <p><b>Extensive or localized larval habitats:</b> Localized</p> <p><b>Primary larval habitats:</b> Primarily man-made habitats</p> <p><b>Transmission intensity:</b> Low to moderate</p> <p><b>Transmission season(s):</b> May to October</p> <p><b>Primary and secondary vector:</b> <i>An. elutus</i>, <i>An. superpictus</i></p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i>, <i>P. vivax</i></p> <p><b>Source of funding:</b> Not stated</p>	
<i>Risk of bias</i>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>

**Balfour 1936 GRC** (Continued)

Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Impossible to blind evaluators to intervention.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Reporting ceased from one clinic. Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Outcome reporting complete.
Baseline characteristics	Low risk	Baseline characteristics reported.
Contamination	Unclear risk	Not stated how far apart the towns were.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

**Castro 2009 TZA**

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Area of city (area around large drain)</p> <p><b>Cluster size:</b> Unclear</p> <p><b>Number of clusters in each arm:</b> Intervention arm: four; control arm: two</p> <p><b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> Any</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Parasite prevalence):</b> 1162, 1513, 1991, 1793, 1711, 900 participants in the surveys</p>
Interventions	<p><b>Intervention:</b> Habitat manipulation with larviciding</p> <p><b>Details of the intervention:</b></p> <p><b>Habitat manipulation:</b> Drains in the city were cleared to increase the water flow and to reduce flooding in the rainy season. Minor repairs such as slab replacement were conducted</p> <p><b>Larviciding:</b> In half the intervention neighbourhoods, larval habitats were treated with</p>

	<p>larvicide by the Urban Malaria Control Program (details not given)  <b>Frequency of application:</b> Not stated  <b>Duration of intervention period:</b> Not stated  <b>Who was responsible for LSM?</b> Drain clearance was initially conducted by a contractor with 90% of the workforce local. Intensive education of the local community led to community-led maintenance of drains. Larviciding was organized by the Urban Malaria Control Program  <b>Co-interventions:</b> None. However ITNs are used in the study area (coverage not stated)  <b>Co-interventions equal in each arm?</b> Not stated</p>	
Outcomes	<b>1. Parasite prevalence</b> (measured with six cross-sectional surveys (one every two months))	
Notes	<p><b>Continent:</b> Africa  <b>Country:</b> Tanzania  <b>Ecosystem:</b> Coastal  <b>Urban or rural:</b> Urban  <b>Extensive or localized larval habitats:</b> Localized  <b>Primary larval habitats:</b> Drains  <b>Transmission intensity:</b> Low to moderate  <b>Transmission season(s):</b> March to June, October to December  <b>Primary and secondary vector:</b> <i>An. gambiae</i>, <i>An. funestus</i>  <b>Primary malaria parasite:</b> <i>P. falciparum</i>  <b>Source of funding:</b> Japan International Cooperation Agency</p>	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Environmental management sites purposefully chosen according to stated criteria
Allocation concealment (selection bias)	High risk	Sites purposefully selected.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Parasite prevalence assessed by blinded reading of blood slides collected from randomly selected participants
Blinding of participants and personnel (performance bias) All outcomes	High risk	No way to blind participants and personnel to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	High risk	Outcomes reported as per methods, however little detail pertaining to the data is reported

Castro 2009 TZA (Continued)

Baseline characteristics	Unclear risk	Stated to be similar, but not specified.
Contamination	High risk	In one EM cluster, drain not maintained; distances of clusters from one another not reported
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

Coulibaly 2011 MLI

Methods	<p><b>Trial design:</b> Cluster-RCT  <b>Type of cluster:</b> Village  <b>Cluster size:</b> Not stated  <b>Number of clusters in each arm:</b> Three  <b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> n/a  <b>Sex:</b> n/a  <b>Co-morbidities and pregnancy:</b> n/a  <b>Primary outcome sample size (EIR):</b> 12 sentinel houses per village  <b>Secondary outcome sample size (Adult mosquito density (measures other than human biting rate)):</b> 12 sentinel houses per village</p>
Interventions	<p><b>Intervention:</b> Larviciding  <b>Details of the intervention:</b>  <b>Larviciding:</b> Larval habitats were treated with <i>Bti</i> (Vectobac®, applied at 400g/ha using a sprayer) and <i>Bs</i> (VectoLex®, dosage not stated)  <b>Frequency of application:</b> Larviciding with <i>Bti</i>: weekly; larviciding with <i>Bs</i>: every two weeks  <b>Duration of intervention period:</b> 18 months  <b>Who was responsible for LSM?</b> Malaria Research and Training Center staff and selected members of the community were trained to conduct larviciding. The local community was educated about the importance of larviciding  <b>Co-interventions:</b> IRS: two rounds of district-wide were conducted, covering all study villages in July to August 2008 and June to July 2009 (coverage not stated)  <b>Co-interventions equal in each arm?</b> Not stated</p>
Outcomes	<p>1. <b>EIR</b> (measured with monthly pyrethrum spray collections in sentinel houses)  2. <b>Adult mosquito density</b> (measured with monthly pyrethrum spray collections in sentinel houses)</p>
Notes	<p><b>Continent:</b> Africa  <b>Country:</b> Mali  <b>Ecosystem:</b> Savannah  <b>Urban or rural:</b> Rural</p>

	<p><b>Extensive or localized larval habitats:</b> Localized</p> <p><b>Primary larval habitats:</b> Brick pits, ponds, tyre prints</p> <p><b>Transmission intensity:</b> High</p> <p><b>Transmission season(s):</b> June to October</p> <p><b>Primary and secondary vector:</b> <i>An. gambiae</i></p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i></p> <p><b>Source of funding:</b> Malaria Research and Training Center, University of Bamako; Research Triangle International; National Institutes of Health; Centers for Disease Control; United States Agency for International Development; United States President's Malaria Initiative</p>	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	Unclear risk	Villages randomly assigned; however method of randomization not specified
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Impossible to blind entomologic data collection.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Stated outcomes reported.
Baseline characteristics	Unclear risk	Baseline characteristics not stated, though villages chosen from same health district
Contamination	Low risk	Villages a sufficient distance apart.
Incorrect analysis	High risk	Not adjusted for clustering.
Other bias	Low risk	Low risk of confounding.

## Fillinger 2008 TZA

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Area of city (ward)</p> <p><b>Cluster size:</b> 0.96 to 15km<sup>2</sup></p> <p><b>Number of clusters in each arm:</b> Intervention arm: three; control arm: 12</p> <p><b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> n/a</p> <p><b>Sex:</b> n/a</p> <p><b>Co-morbidities and pregnancy:</b> n/a</p> <p><b>Primary outcome sample size (EIR):</b> 67 sentinel sites</p>
Interventions	<p><b>Intervention:</b> Larviciding alone</p> <p><b>Details of the intervention:</b></p> <p><b>Larviciding:</b> Open (light-exposed) larval habitats were treated with <i>Bti</i> water-dispersible granules (VectoBac®, applied at 0.04g/m<sup>2</sup> using knapsack sprayers), <i>Bs</i> water-dispersible granules (VectoLex®, applied at 0.2g/m<sup>2</sup> using knapsack sprayers), <i>Bti</i> corn granule formulations (VectoBac®, applied at 1g/m<sup>2</sup> by hand) and <i>Bs</i> corn granule formulations (VectoLex®, applied at 3g/m<sup>2</sup> by hand). Closed habitats (the main larval habitat of <i>Culex quinquefasciatus</i>, a nuisance-biting mosquito) were treated with <i>Bs</i> corn cob granules (VectoLex®, applied at 1g/m<sup>2</sup> by hand).</p> <p><b>Frequency of application:</b> Larviciding of open habitats: weekly; closed habitats: every three months</p> <p><b>Duration of intervention period:</b> 15 months</p> <p><b>Who was responsible for LSM?</b> Open habitats were treated by modestly paid members of the community, Mosquito Contro CORPs, each of which was assigned to a specific area (mtaa). An additional team of CORPs was responsible for treating closed habitats. CORPs reported to the Ward Office</p> <p><b>Co-interventions:</b> None. However ITNs were used in the study area (coverage not stated)</p> <p><b>Co-interventions equal in each arm?</b> Not stated</p>
Outcomes	<p>1. <b>EIR</b> (measured with weekly CDC light trap catches and pyrethrum spray catches)</p> <p>2. <b>Adult mosquito density (human biting rate)</b> (measured with weekly CDC light trap catches and pyrethrum spray catches)</p>
Notes	<p><b>Continent:</b> Africa</p> <p><b>Country:</b> Tanzania</p> <p><b>Ecosystem:</b> Coastal</p> <p><b>Urban or rural:</b> Urban</p> <p><b>Extensive or localized larval habitats:</b> Localized</p> <p><b>Primary larval habitats:</b> Man-made habitats exposed to sunlight</p> <p><b>Transmission intensity:</b> Low to moderate</p> <p><b>Transmission season(s):</b> March to June (primary), October to December (secondary)</p> <p><b>Primary and secondary vector:</b> <i>An. gambiae</i> s.s., <i>An. arabiensis</i></p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i></p> <p><b>Source of funding:</b> Swiss Tropical Institute, the United States Agency for International Development (Environmental Health Project, Dar es Salaam Mission and the United States President's Malaria Initiative), the Bill and Melinda Gates Foundation, Valent BioSciences Corporation, Wellcome Trust</p>

Fillinger 2008 TZA (Continued)

<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Impossible to blind entomologic data collection.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Complete outcome reporting.
Baseline characteristics	Low risk	Baseline mosquito densities reported.
Contamination	High risk	Control and intervention clusters are adjacent.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

Fillinger 2009 KEN

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Highland valley villages</p> <p><b>Cluster size:</b> Between 107 and 214 individuals in each group (2-4km sq)</p> <p><b>Number of clusters in each arm:</b> Three</p> <p><b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> 6 months to 10 years</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Malaria incidence):</b> 720 participants</p> <p><b>Secondary outcome sample size (EIR):</b> 10 sentinel sites per valley</p>

Interventions	<p><b>Intervention:</b> Larviciding alone</p> <p><b>Details of the intervention:</b></p> <p><b>Larviciding:</b> Larval habitats were treated with <i>Bs</i> water-dispersible and corn granules (VectoLex®) during months one to six, then <i>Bti</i> water-dispersible and corn granules (VectoBac®) during months seven to 19</p> <p><b>Frequency of application:</b> Weekly</p> <p><b>Duration of intervention period:</b> 19 months</p> <p><b>Who was responsible for LSM?</b> Study staff</p> <p><b>Co-interventions:</b> ITNs (coverage: intervention arm: 25% to 51%; non-intervention arm: 24% to 51%)</p> <p><b>Co-interventions equal in each arm?</b> Yes</p>
Outcomes	<p><b>1. Malaria incidence</b> (measured by three cross-sectional surveys in the pre-intervention period, and three cross-sectional surveys in the post-intervention period, two months apart, using rapid malaria tests and microscopy)</p> <p><b>2. EIR</b> (measured by monthly indoor resting collection (pyrethrum spray collection) at sentinel sites)</p> <p><b>3. Adult mosquito density (human biting rate)</b> (measured by monthly indoor resting collection (pyrethrum spray collection) at sentinel sites)</p> <p><b>4. Adult mosquito density (measures other than human biting rate)</b> (measured by monthly indoor resting collection (pyrethrum spray collection) at sentinel sites)</p>
Notes	<p><b>Continent:</b> Africa</p> <p><b>Country:</b> Kenya</p> <p><b>Ecosystem:</b> Highland</p> <p><b>Urban or rural:</b> Rural</p> <p><b>Extensive or localized larval habitats:</b> Localized and extensive</p> <p><b>Primary larval habitats:</b> Small streams, papyrus swamps</p> <p><b>Transmission intensity:</b> Moderate</p> <p><b>Transmission season(s):</b> April to June, November to January</p> <p><b>Primary and secondary vector:</b> <i>An. gambiae</i> s.l., <i>An. funestus</i> s.l.</p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i></p> <p><b>Source of funding:</b> Environmental Health Project of the United States Agency for International Development</p>

**Risk of bias**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Malaria incidence determined by blinded reading of blood smears

**Fillinger 2009 KEN** (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Complete outcome reporting.
Baseline characteristics	Low risk	Baseline characteristics reported and similar.
Contamination	Low risk	Clusters at least 1 km apart.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

**Geissbühler 2009 TZA**

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Ward</p> <p><b>Cluster size:</b> Total study population of 4761</p> <p><b>Number of clusters in each arm:</b> Intervention arm: three; control arm: 12</p> <p><b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> 0 to five years</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Parasite prevalence):</b> 4450 participants</p> <p><b>Secondary outcome sample size (EIR):</b> 268 sentinel sites (4 sites in each of 67 mtaa)</p>
Interventions	<p><b>Intervention:</b> Larviciding</p> <p><b>Details of the intervention:</b></p> <p><b>Larviciding:</b> Open (light-exposed) larval habitats were treated with <i>Bti</i> water-dispersible granules (VectoBac®, applied at 0.04g/m<sup>2</sup> using knapsack sprayers) and <i>Bti</i> corn granules (VectoBac®, applied at 1 g/m<sup>2</sup> by hand). Closed habitats (the main larval habitat of <i>Culex quinquefasciatus</i>, a nuisance-biting mosquito) were treated with <i>Bs</i> corn cob granules (VectoLex®, applied at a dosage rate of 1 g/m<sup>2</sup> by hand).</p> <p><b>Frequency of application:</b> Larviciding of open habitats: weekly; closed habitats: every three months</p> <p><b>Duration of intervention period:</b> 12 months</p> <p><b>Who was responsible for LSM?</b> Open habitats were treated by modestly paid members of the community, Mosquito Contro CORPs, each of which was assigned to a specific area (mtaa). An additional team of CORPs was responsible for treating closed habitats. CORPs reported to the Ward Office</p> <p><b>Co-interventions:</b> None. However ITNs were used in the study area. Coverage: Non-</p>

	intervention area: 23.6% (year 1), 27.7% (year 2), 24.6% (year 3); Intervention area: 23.3% (year 1), 26.3% (year 2), 22.4% (year 3) <b>Co-interventions equal in each arm?</b> Yes	
Outcomes	<p><b>1. Parasite prevalence</b> (measured with randomized, cluster-sampled household surveys in May to September 2004, November to July 2004, September 2005 to May 2006, July 2006 to March 2007, with parasite prevalence determined by microscopy)</p> <p><b>2. EIR</b> (measured by (1) human landing catch for 45 minutes of each hour from 6pm to 6am, at sentinel sites every four weeks, and (2) laboratory analysis of specimens for sporozoites)</p>	
Notes	<p><b>Continent:</b> Africa  <b>Country:</b> Tanzania  <b>Ecosystem:</b> Coastal  <b>Urban or rural:</b> Urban  <b>Extensive or localized larval habitats:</b> Localized  <b>Primary larval habitats:</b> Man-made habitats exposed to sunlight  <b>Transmission intensity:</b> Low to moderate  <b>Transmission season(s):</b> July to September  <b>Primary and secondary vector:</b> <i>An. gambiae</i> s.l.  <b>Primary malaria parasite:</b> <i>P. falciparum</i>  <b>Source of funding:</b> Bill &amp; Melinda Gates Foundation; Valent Biosciences Corporation; United States Centers for Disease Control and Prevention and United States Agency for International Development (Environmental Health Program, Dar es Salaam Mission and the President's Malaria Initiative, all administered through Research Triangle International); Wellcome Trust</p>	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Malaria prevalence determined by blinded reading of blood smears of randomly chosen individuals
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers to intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up

Geissbühler 2009 TZA (Continued)

Selective reporting (reporting bias)	High risk	All household members tested, but results presented only for children aged 0 to five years
Baseline characteristics	Unclear risk	Baseline characteristics not specified.
Contamination	Low risk	Most of control clusters > 1 km from intervention clusters.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

Majambere 2010 GMB

Methods	<p><b>Trial design:</b> Randomized cross-over trial</p> <p><b>Type of cluster:</b> Area of land (zone)</p> <p><b>Cluster size:</b> Each zone was 12 x 8 km and was subdivided into three parallel 4 km wide bands perpendicular to the river. Study villages were recruited from the central band of each zone</p> <p><b>Number of clusters in each arm:</b> Two</p> <p><b>Adjusted for clustering?</b> Yes, included as random effects.</p>
Participants	<p><b>Age:</b> Six months to 10 years</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Malaria incidence):</b> Zone 1: 496; Zone 2: 508; Zone 3: 525; Zone 4: 510</p> <p><b>Secondary outcome sample size (EIR):</b> 15 traps per zone, divided between the villages with one to three sentinel houses per village proportional to village size</p>
Interventions	<p><b>Intervention:</b> Larviciding alone</p> <p><b>Larviciding:</b> Larval habitats in areas of low vegetation coverage were treated with <i>Bti</i> water-dispersible granules (VectoBac® AM65-52, applied at 0.2kg/hectare using knapsack compression sprayers). Less accessible larval habitats in areas of high vegetation coverage were treated with <i>Bti</i> corn granules (VectoBac® AM65-52, applied at 5.0kg/hectare by hand from buckets or using motorized knapsack granule blowers)</p> <p><b>Frequency of application:</b> Weekly</p> <p><b>Duration of intervention period:</b> June to November 2006 (6 months), May to November 2007 (7 months)</p> <p><b>Who was responsible for LSM?</b> Field applicators were recruited from local communities and trained for one month before larviciding. Applicators were supervised by one field supervisor in each of the four study zones</p> <p><b>Co-interventions:</b> None. However ITNs were used in the study area (coverage: Zone 1: 27.6% (2006), 37.2% (2007); Zone 2: 6.1% (2006), 81.4% (2007); Zone 3: 38.3% (2006), 71.2% (2007); Zone 4: 34.3% (2006), 70.4% (2007))</p>

Co-interventions equal in each arm? Yes		
Outcomes	<p><b>1. Malaria incidence</b> (measured with passive case detection by study nurses and government village health workers)</p> <p><b>2. Parasite prevalence</b> (measured with two cross-sectional surveys per year, one before and one after the main transmission season)</p> <p><b>3. Splenomegaly prevalence</b> (measured with two cross-sectional surveys per year, one before and one after the main transmission season)</p> <p><b>4. EIR</b> (measured using CDC light traps at 60 sentinel sites every two weeks)</p> <p><b>5. Adult mosquito density (measures other than human biting rate)</b> (measured using CDC light traps at 60 sentinel sites every two weeks)</p>	
Notes	<p><b>Continent:</b> Africa</p> <p><b>Country:</b> The Gambia</p> <p><b>Ecosystem:</b> Savannah</p> <p><b>Urban or rural:</b> Rural</p> <p><b>Extensive or localized larval habitats:</b> Extensive</p> <p><b>Primary larval habitats:</b> Flood plains, rice paddy fields</p> <p><b>Transmission intensity:</b> High</p> <p><b>Transmission season(s):</b> July to October</p> <p><b>Primary and secondary vector:</b> <i>An. gambiae</i></p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i></p> <p><b>Source of funding:</b> National Institutes of Health</p>	
<b>Risk of bias</b>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Each area served as its own control.
Allocation concealment (selection bias)	Low risk	Each area served as its own control.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Data collectors blinded to intervention status.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Outcomes all reported as specified.
Baseline characteristics	Low risk	Each area served as its own control.

Contamination	Low risk	Clusters bordered by 4 km zones.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	Low risk	Low risk of confounding.

**Samnotra 1980 IND**

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Town</p> <p><b>Cluster size:</b> Intervention arm 92,000 individuals; control arm 5000 individuals</p> <p><b>Number of clusters in each arm:</b> One</p> <p><b>Adjusted for clustering?</b> n/a</p>
Participants	<p><b>Age:</b> Any</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Malaria incidence):</b> Intervention arm: 92,000; control arm: 5000</p> <p><b>Secondary outcome sample size (Adult mosquito density (measures other than human biting rate)):</b> 80 sentinel sites</p>
Interventions	<p><b>Intervention:</b> Habitat manipulation with larviciding</p> <p><b>Details of the intervention:</b></p> <p><b>Habitat manipulation:</b> attempts to persuade householders to remove domestic water storage containers made with limited success</p> <p><b>Larviciding:</b> Larval habitats (excluding stored domestic water) were treated with pirimiphos-methyl (applied at 12.5g active ingredient/ha, with knapsack sprayers)</p> <p><b>Frequency of application:</b> Weekly</p> <p><b>Duration of intervention period:</b> 15 months</p> <p><b>Who was responsible for LSM?</b> Study staff were responsible for larviciding. Attempts were made to persuade the local community to conduct habitat modification</p> <p><b>Co-interventions:</b> Case management (active case detection); presumptive treatment of all fever cases with chloroquine (coverage not stated)</p> <p><b>Co-interventions equal in each arm?</b> Yes</p>
Outcomes	<p><b>1. Malaria incidence</b> (measured with continuous community surveillance)</p> <p><b>2. Parasite prevalence</b> (measured with community surveys)</p> <p><b>3. Adult mosquito density (measures other than human biting rate):</b> (measured with weekly indoor resting collections using an aspirator, at sentinel sites. 16 of 80 sentinel sites visited each week day)</p>
Notes	<p><b>Continent:</b> Asia</p> <p><b>Country:</b> India</p> <p><b>Ecosystem:</b> Desert fringe</p> <p><b>Urban or rural:</b> Urban</p> <p><b>Extensive or localized larval habitats:</b> Localized</p> <p><b>Primary larval habitats:</b> Containers, wells, rainwater pools, canals, stagnant pools in</p>

	drains <b>Transmission intensity:</b> Low <b>Transmission season(s):</b> May to September <b>Primary and secondary vector:</b> <i>An. culicifacies</i> , <i>An. stephensi</i> <b>Primary malaria parasite:</b> <i>P. falciparum</i> <b>Source of funding:</b> Haryana State Health Authorities; Alkali and Chemical Corporation of India Ltd; ICI Plant Protection Division	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information given as to blinding of those seeing patients and reading blood slides
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Outcomes not specified.
Baseline characteristics	Unclear risk	Baseline characteristics not stated; intervention town much larger than control town
Contamination	Low risk	8 km between control and intervention towns.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

## Santiago 1960 PHL

Methods	<p><b>Trial design:</b> Controlled before-and-after trial  <b>Type of cluster:</b> Area of town (barrio)  <b>Cluster size:</b> 25,545 people (intervention cluster)  <b>Number of clusters in each arm:</b> One  <b>Adjusted for clustering?</b> No</p>	
Participants	<p><b>Age:</b> Two to 10 years  <b>Sex:</b> Any  <b>Co-morbidities and pregnancy:</b> Any  <b>Primary outcome sample size (Parasite prevalence):</b> Intervention arm: 500; control arm: 200  <b>Secondary outcome sample size (Adult mosquito density (measures other than human biting rate)):</b> Not stated</p>	
Interventions	<p><b>Intervention:</b> Habitat manipulation alone  <b>Details of the intervention:</b>  <b>Habitat manipulation:</b> automatic siphons were constructed over two streams which were the main larval habitats. Water was flushed to control larvae over distances of 1073m and 2897m downstream, respectively. Existing siphons were repaired  <b>Frequency of application:</b> Constant  <b>Duration of intervention period:</b> 12 months  <b>Who was responsible for LSM?</b> United States Public Health Service  <b>Co-interventions:</b> None  <b>Co-interventions equal in each arm?</b> n/a</p>	
Outcomes	<p>1. <b>Parasite prevalence</b> (measured with community-based cross-sectional surveys)  2. <b>Splenomegaly prevalence</b> (measured with community-based cross-sectional surveys)  3. <b>Adult mosquito density (measures other than human biting rate)</b> (sampled with human baited traps and carabao baited traps every two weeks)</p>	
Notes	<p><b>Continent:</b> Asia  <b>Country:</b> Philippines  <b>Ecosystem:</b> Coastal  <b>Urban or rural:</b> Urban  <b>Extensive or localized larval habitats:</b> Localized  <b>Primary larval habitats:</b> Streams fed by a lake  <b>Transmission intensity:</b> High  <b>Transmission season(s):</b> Not stated  <b>Primary and secondary vector:</b> <i>An. minimus flavirostris</i>  <b>Primary malaria parasite:</b> <i>P. falciparum</i>  <b>Source of funding:</b> Malaria Eradication Project, San Pablo City</p>	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	High risk	Not randomly chosen.

**Santiago 1960 PHL** (Continued)

Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Sampling method for periodic surveys not stated, though reportedly surveyed 50% to 80% of children per year
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Outcomes reported as specified.
Baseline characteristics	Unclear risk	Clusters in same town, but no baseline characteristics specified. Only 6 months of pre-treatment entomological data were collected
Contamination	Low risk	Clusters 8 km apart.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

**Sharma 2008 IND**

Methods	<p><b>Trial design:</b> Controlled before-and-after trial</p> <p><b>Type of cluster:</b> Village</p> <p><b>Cluster size:</b> Intervention arm: 271 individual; control arms: 143 and 156 individuals</p> <p><b>Number of clusters in each arm:</b> Intervention arm: one; control arm: two</p> <p><b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> Any</p> <p><b>Sex:</b> Any</p> <p><b>Co-morbidities and pregnancy:</b> Any</p> <p><b>Primary outcome sample size (Malaria incidence):</b> Total study population: 570</p> <p><b>Secondary outcome sample size (Parasite prevalence):</b> 40% households sampled in each of the three clusters (combined total population 570)</p>
Interventions	<p><b>Intervention:</b> Habitat modification alone</p> <p><b>Details of the intervention:</b></p> <p><b>Habitat modification:</b> Construction of a small concrete dam 25m x 4m across the stream in the village to provide water for irrigation reduced the number of larval habitats in the village</p> <p><b>Frequency of application:</b> n/a</p>

	<p><b>Duration of intervention period:</b> 23 months</p> <p><b>Who was responsible for LSM?</b> The district administration constructed the dam at the request of the village panchayat (governing body)</p> <p><b>Co-interventions:</b> None. However indoor residual spraying was conducted annually with DDT and a synthetic pyrethroid (coverage: 60% to 80%)</p> <p><b>Co-interventions equal in each arm?</b> Yes</p>
Outcomes	<p><b>1. Malaria incidence</b> (measured with weekly longitudinal surveillance and continuous passive case detection)</p> <p><b>2. Parasite prevalence</b> (measured with three cross-sectional surveys per year)</p>
Notes	<p><b>Continent:</b> Asia</p> <p><b>Country:</b> India</p> <p><b>Ecosystem:</b> Forest</p> <p><b>Urban or rural:</b> Rural</p> <p><b>Extensive or localized larval habitats:</b> Localized</p> <p><b>Primary larval habitats:</b> Streams (<i>An. fluviatilis</i>), stagnant pools, ditches, irrigation channels (<i>An. culicifacies</i>)</p> <p><b>Transmission intensity:</b> Moderate</p> <p><b>Transmission season(s):</b> October to December</p> <p><b>Primary and secondary vector:</b> <i>An. fluviatilis</i>, <i>An. culicifacies</i></p> <p><b>Primary malaria parasite:</b> <i>P. falciparum</i></p> <p><b>Source of funding:</b> Indian Council of Medical Research; Ministry of Health and Family Welfare, Government of India</p>

**Risk of bias**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomly chosen.
Allocation concealment (selection bias)	High risk	Not randomly chosen.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Surveillance personnel not blinded to intervention status.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Outcomes reported as specified.
Baseline characteristics	Low risk	Baseline incidences reported and similar.

Sharma 2008 IND (Continued)

Contamination	Low risk	Control and intervention villages 30 km apart.
Incorrect analysis	Unclear risk	Cluster adjustment not applicable.
Other bias	High risk	High risk of confounding.

Shililu 2007 ERI

Methods	<p><b>Trial design:</b> Cluster-RCT  <b>Type of cluster:</b> Village  <b>Cluster size:</b> Not stated.  <b>Number of clusters in each arm:</b> Four  <b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> n/a  <b>Sex:</b> n/a  <b>Co-morbidities and pregnancy:</b> n/a  <b>Primary outcome sample size (Adult mosquito density (measures other than human biting rate)):</b> 12 light traps per study village  <b>Secondary outcome sample size:</b> n/a</p>
Interventions	<p><b>Intervention:</b> Habitat modification with larviciding  <b>Details of the intervention:</b>  <b>Habitat modification:</b> Filling or drainage of rain pools, puddles at water supply points and stream bed pools  <b>Larviciding:</b> Larval habitats which could not be eliminated by habitat modification were treated in rotation with <i>Bti</i> granules (VectoBac®, applied at 11.2kg/ha using a granular spreader), <i>Bs</i> corn granules (VectoLex®, applied at 22.4kg/ha using a granular spreader) and temephos (Abate®, applied at 112 ml/ha using a liquid sprayer)  <b>Frequency of application:</b> Weekly  <b>Duration of intervention period:</b> 24 months  <b>Who was responsible for LSM?</b> Study staff; local community  <b>Co-interventions:</b> None. However ITNs and IRS were conducted as part of the national malaria control programme (coverage not stated)  <b>Co-interventions equal in each arm?</b> Not stated</p>
Outcomes	<p><b>1. Adult mosquito density (measures other than human biting rate)</b> (measured using CDC light traps from dusk to dawn (12 hours) 2 days per week for 24 months)</p>
Notes	<p><b>Continent:</b> Africa  <b>Country:</b> Eritrea  <b>Ecosystem:</b> Desert fringe, highland and lowland  <b>Urban or rural:</b> Rural  <b>Extensive or localized larval habitats:</b> Localized  <b>Primary larval habitats:</b> Stream bed pools, canals, drainage channels, wells, communal water supply points  <b>Transmission intensity:</b> Not stated</p>

	<p><b>Transmission season(s):</b> Short period of transmission coinciding with short rainy season  <b>Primary and secondary vector:</b> <i>An. arabiensis</i>  <b>Primary malaria parasite:</b> <i>P. falciparum</i>  <b>Source of funding:</b> United States Agency for International Development, Environmental Health Project, International Center of Insect Physiology and Ecology, National Institutes of Health</p>	
<b>Risk of bias</b>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>
Random sequence generation (selection bias)	Unclear risk	Clusters randomly assigned; however method of randomization not stated
Allocation concealment (selection bias)	Unclear risk	One village randomly selected in each zone; however method of randomization not stated
Blinding of outcome assessment (detection bias) All outcomes	High risk	Surveillance personnel not blinded to intervention status.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	Low risk	Outcomes reported as specified.
Baseline characteristics	Unclear risk	Pairs of villages selected to be similar but baseline characteristics not reported
Contamination	Unclear risk	Distance of villages from one another not stated.
Incorrect analysis	High risk	Not adjusted for clustering.
Other bias	Low risk	Low risk of confounding.

## Yapabandara 2001 LKA

Methods	<p><b>Trial design:</b> Cluster-RCT  <b>Type of cluster:</b> Village  <b>Cluster size:</b> Four villages of &lt;500 people, four villages of 600-1100 people  <b>Number of clusters in each arm:</b> Four  <b>Adjusted for clustering?</b> No</p>	
Participants	<p><b>Age:</b> Any  <b>Sex:</b> Any  <b>Co-morbidities and pregnancy:</b> Not stated  <b>Primary outcome sample size (Malaria incidence):</b> 4566 (pre-intervention); 4659 (post-intervention)  <b>Secondary outcome sample size (Parasite prevalence):</b> 3351</p>	
Interventions	<p><b>Intervention:</b> Larviciding  <b>Details of the intervention:</b>  <b>Larviciding:</b> Gem pits and riverbed and stream pools were treated with pyriproxyfen S-31183 granules (Adeal® 0.5%, applied at 2g/m<sup>3</sup>).  <b>Frequency of application:</b> December 1994, June to July 1995, November 1995  <b>Duration of intervention period:</b> 12 months  <b>Who was responsible for LSM?</b> Study staff  <b>Co-interventions:</b> Case management following whole community survey (coverage comprehensive)  <b>Co-interventions equal in each arm?</b> Yes</p>	
Outcomes	<p><b>1. Malaria incidence</b> (measured by passive case detection)  <b>2. Parasite prevalence</b> (measured by cross-sectional surveys (two in pre-intervention year, two in post-intervention year)  <b>3. Adult mosquito density (measures other than human biting rate)</b> (measured by window exit trap collection, pyrethrum spray sheet, indoor human landing catch, cattle-baited hut collection, cattle-baited net trap collection at sentinel sites)</p>	
Notes	<p><b>Continent:</b> Asia  <b>Country:</b> Sri Lanka  <b>Ecosystem:</b> Forest  <b>Urban or rural:</b> Rural  <b>Extensive or localized larval habitats:</b> Localized  <b>Primary larval habitats:</b> Abandoned gem mine pits  <b>Transmission intensity:</b> Moderate to high  <b>Transmission season(s):</b> October to December  <b>Primary and secondary vector:</b> <i>An. culicifacies</i>, <i>An. subpictus</i> Grassi  <b>Primary malaria parasite:</b> <i>P. vivax</i>  <b>Source of funding:</b> Sumitomo Corporation, United Nations Development Program, World Bank, WHO</p>	
<i>Risk of bias</i>		
<b>Bias</b>	<b>Authors' judgement</b>	<b>Support for judgement</b>

**Yapabandara 2001 LKA** (Continued)

Random sequence generation (selection bias)	Unclear risk	Randomly assigned, though method not stated.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Parasite prevalence determined by blinded reading of blood slides, but incidence in local clinics and blinding impossible
Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	High risk	Several methods of collection of entomologic data described, not all reported
Baseline characteristics	Unclear risk	Characteristics not reported, but stratification and randomization were performed based on baseline data. Baseline data for 12 months pre-treatment is presented
Contamination	Low risk	At least 1.5 km between villages.
Incorrect analysis	High risk	Not adjusted for clustering.
Other bias	Low risk	Low risk of confounding.

**Yapabandara 2004 LKA**

Methods	<p><b>Trial design:</b> Cluster-RCT  <b>Type of cluster:</b> Village  <b>Cluster size:</b> Each of the 12 villages was defined as a circle of 1.5km radius centred on a stream or irrigation canal  <b>Number of clusters in each arm:</b> Six  <b>Adjusted for clustering?</b> No</p>
Participants	<p><b>Age:</b> Any  <b>Sex:</b> Any  <b>Co-morbidities and pregnancy:</b> Any  <b>Primary outcome sample size (Malaria incidence):</b> 15415 individuals  <b>Secondary outcome sample size (Adult mosquito density (measures other than human biting rate)):</b> Not stated</p>

Interventions	<p><b>Intervention:</b> Larviciding alone</p> <p><b>Details of the intervention:</b></p> <p><b>Larviciding:</b> Riverbed pools, streams, irrigation ditches, quarry pits and agricultural wells were treated with pyriproxyfen S-31183 0.5% granules (Sumilarv®, applied at 2g/ m<sup>3</sup> using a spoon).</p> <p><b>Frequency of application:</b> Two rounds of larviciding were conducted: July 2001 and December 2001</p> <p><b>Duration of intervention period:</b> 12 months</p> <p><b>Who was responsible for LSM?</b> Study staff</p> <p><b>Co-interventions:</b> Larvivorous fish: <i>Poecillia reticulata</i> were added to drinking water wells. IRS was conducted as part of the national malaria control programme during November and June each year (coverage not stated)</p> <p><b>Co-interventions equal in each arm?</b> Yes</p>
Outcomes	<p><b>1. Malaria incidence</b> (measured by passive case detection at two field clinics and two clinics at outpatient departments at a hospital and dispensary)</p> <p><b>2. Adult mosquito density (measures other than human biting rate)</b> (measured using cattle-baited huts at sentinel sites)</p>
Notes	<p><b>Continent:</b> Asia</p> <p><b>Country:</b> Sri Lanka</p> <p><b>Ecosystem:</b> 'Dry zone'</p> <p><b>Urban or rural:</b> Rural</p> <p><b>Extensive or localized larval habitats:</b> Localized and extensive</p> <p><b>Primary larval habitats:</b> River bed pools, streams, irrigation ditches (dry season); rice paddies (rainy season)</p> <p><b>Transmission intensity:</b> Moderate</p> <p><b>Transmission season(s):</b> January to March</p> <p><b>Primary and secondary vector:</b> <i>An. culifacies</i>, <i>An. subpictus</i></p> <p><b>Primary malaria parasite:</b> <i>P. vivax</i></p> <p><b>Source of funding:</b> United Nations Development Program, World Bank, World Health Organization Special Program for Research and Training in Tropical Diseases</p>

**Risk of bias**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomly assigned, though method not stated.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Parasite prevalence determined by blinded reading of blood slides, but incidence measured at local clinics and blinding impossible

**Yapabandara 2004 LKA** (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	Impossible to blind implementers or inhabitants to intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Individual patients not followed up therefore not possible to measure percentage loss to follow-up
Selective reporting (reporting bias)	High risk	Several methods of collection of entomologic data described, not all reported
Baseline characteristics	Unclear risk	Characteristics not reported, but stratification and randomization performed based on baseline data
Contamination	Unclear risk	Distance of villages from one another not specified.
Incorrect analysis	High risk	Not adjusted for clustering.
Other bias	Low risk	Low risk of confounding.

**Characteristics of excluded studies** [ordered by study ID]

Study	Reason for exclusion
Anon (a)	We could not obtain the full-text article.
Anon (b)	We could not obtain the full-text article.
Anon (c)	We could not obtain the full-text article.
Anon (d)	We could not obtain the full-text article.
Baduilin 1931	We could not obtain the full-text article.
Barbazan 1998	No control.
Berti 1946	We could not obtain the full-text article.
Bini 1925	We could not obtain the full-text article.
Booker 1936	We could not obtain the full-text article.
Castro 2000	No control.

(Continued)

Castro 2002	No control.
Cross 1933	No control.
Curry 1935	We could not obtain the full-text article.
Davis 1928	We could not obtain the full-text article.
Dryenski 1936	Study did not have one year of baseline data.
Dua 1991	Uneven application of other malaria control interventions between control and intervention areas: weekly active surveillance and treatment of fever cases in intervention area, but not in controls
Dua 1997	Uneven application of other malaria control interventions between control and intervention areas: weekly active surveillance and treatment of fever cases in intervention area, but not in controls
Elmendorff 1948	No control.
Essed 1932	No control.
Fillinger 2006	No control.
Gallus 1970	We could not obtain the full-text article.
Gammans 1926	We could not obtain the full-text article.
Gladney 1968	No control.
Guelmino 1928	We could not obtain the full-text article.
Hackett 1925	We could not obtain the full-text article.
Ivorro Canno 1975	Uneven application of other malaria control interventions between control and intervention areas: chloroquine chemoprophylaxis applied in intervention village and not in control village
Kinde-Gazard 2012	Insufficient information reported to determine eligibility.
Kumar 1998	No control.
Lee 2010	No control.
Martini 1931	We could not obtain the full-text article.
Mulligan 1982	No control.
Murray 1984	No control.
Okan 1949	We could not obtain the full-text article.

(Continued)

Rodriguez Ocana 2003	We could not obtain the full-text article.
Rojas 1987	Uneven application of other malaria control interventions between control and intervention areas: indoor residual spraying with DDT every six to 10 months used in intervention area, but not in control
Sharma 1989	Uneven application of other malaria control interventions between control and intervention areas: weekly active surveillance and treatment in intervention area, as well as extensive use of larvivorous fish; control villages changed multiple times over the life of the study, compromising comparability
Singh 1984	No control.
Singh 1989	Uneven application of other malaria control interventions between control and intervention areas: weekly active surveillance and treatment in intervention area, compared to bimonthly in control; DDT indoor residual spraying in control villages
Stratman-Thomas 1937	We could not obtain the full-text article.
Symes 1931	Larval habitats differed between control and intervention sites at baseline
Vittal 1982	No control.
Williamson 1934	We could not obtain the full-text article.
Xu 1992	No control.
Yasuoka 2006	Study did not have one year of baseline data.
Yohannes 2005	Larval habitats differed between control and intervention sites at baseline

## DATA AND ANALYSES

### Comparison 1. Habitat modification alone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Malaria incidence	1		Rate Ratio (Fixed, 95% CI)	Totals not selected
1.1 Controlled before-and-after trials; pre-intervention	1		Rate Ratio (Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Controlled before-and-after trials; post-intervention	1		Rate Ratio (Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Parasite prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Controlled before-and-after trials; pre-intervention	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 Controlled before-and-after trials; post-intervention	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

### Comparison 2. Habitat modification with larviciding

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Parasite prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Controlled before-and-after trials; pre-intervention	1	1737	Risk Ratio (M-H, Fixed, 95% CI)	0.44 [0.30, 0.64]
1.2 Controlled before-and-after trials; post-intervention	1	1538	Risk Ratio (M-H, Fixed, 95% CI)	0.25 [0.19, 0.34]
2 Splenomegaly prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Controlled before-and-after trials; pre-intervention	1	1737	Risk Ratio (M-H, Fixed, 95% CI)	0.58 [0.51, 0.66]
2.2 Controlled before-and-after trials; post-intervention	1	1538	Risk Ratio (M-H, Fixed, 95% CI)	0.41 [0.36, 0.47]

### Comparison 3. Habitat manipulation alone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Parasite prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Controlled before-and-after trials; pre-intervention	1	847	Risk Ratio (M-H, Fixed, 95% CI)	1.37 [0.70, 2.68]
1.2 Controlled before-and-after trials; post-intervention	1	846	Risk Ratio (M-H, Fixed, 95% CI)	0.02 [0.00, 0.15]
2 Splenomegaly prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Controlled before-and-after trials; pre-intervention	1	832	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.31, 0.85]
2.2 Controlled before-and-after trials; post-intervention	1	846	Risk Ratio (M-H, Fixed, 95% CI)	0.02 [0.00, 0.17]

### Comparison 4. Habitat manipulation with larviciding

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Malaria incidence	1		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Controlled before-and-after trials; pre-intervention	1	97000	Rate Ratio (Fixed, 95% CI)	1.14 [1.01, 1.28]
1.2 Controlled before-and-after trials; post-intervention	1	97000	Rate Ratio (Fixed, 95% CI)	0.24 [0.22, 0.25]
2 Parasite prevalence	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Controlled before-and-after trials; pre-intervention	1	1887	Risk Ratio (M-H, Fixed, 95% CI)	1.44 [0.99, 2.11]
2.2 Controlled before-and-after trials; post-intervention	1	2713	Risk Ratio (M-H, Fixed, 95% CI)	0.54 [0.45, 0.65]

## Comparison 5. Larviciding alone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Malaria incidence	3		Rate Ratio (Random, 95% CI)	Subtotals only
1.1 Cluster-RCTs; pre-intervention	2	19981	Rate Ratio (Random, 95% CI)	0.95 [0.84, 1.08]
1.2 Cluster-RCTs; post-intervention	2	20124	Rate Ratio (Random, 95% CI)	0.26 [0.22, 0.31]
1.3 Controlled before-and-after trials; pre-intervention	1	400	Rate Ratio (Random, 95% CI)	1.28 [0.75, 2.20]
1.4 Controlled before-and-after trials; post-intervention	1	663	Rate Ratio (Random, 95% CI)	0.69 [0.33, 1.43]
2 Malaria incidence (post-intervention) sensitivity analysis	2		Rate Ratio (Fixed, 95% CI)	Subtotals only
2.1 Not adjusted for clustering	2		Rate Ratio (Fixed, 95% CI)	0.26 [0.22, 0.30]
2.2 Adjusted using ICC = 0.01	2		Rate Ratio (Fixed, 95% CI)	0.25 [0.16, 0.40]
2.3 Adjusted using ICC = 0.1	2		Rate Ratio (Fixed, 95% CI)	0.25 [0.06, 0.98]
3 Parasite prevalence	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Cluster-RCTs; pre-intervention	1	3351	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.66, 1.56]
3.2 Cluster-RCTs; post-intervention	1	2963	Risk Ratio (M-H, Fixed, 95% CI)	0.11 [0.05, 0.22]
3.3 Controlled before-and-after trials; pre-intervention	1	2439	Risk Ratio (M-H, Fixed, 95% CI)	1.29 [1.04, 1.59]
3.4 Controlled before-and-after trials; post-intervention	1	2374	Risk Ratio (M-H, Fixed, 95% CI)	0.60 [0.42, 0.87]
4 Parasite prevalence (post-intervention) sensitivity analysis	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Not adjusted for clustering	1	2963	Risk Ratio (M-H, Fixed, 95% CI)	0.11 [0.05, 0.22]
4.2 Adjusted using ICC = 0.01	1	631	Risk Ratio (M-H, Fixed, 95% CI)	0.13 [0.03, 0.56]
4.3 Adjusted using ICC = 0.1	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.16 [0.01, 3.14]

## Comparison 6. Larval source management versus control

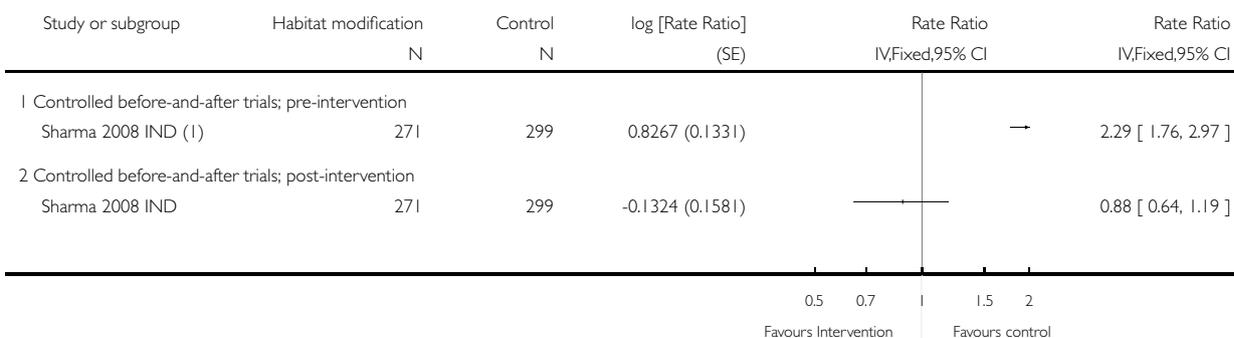
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Malaria incidence	5		Rate Ratio (Random, 95% CI)	Subtotals only
1.1 Cluster-RCTs; pre-intervention	2	19981	Rate Ratio (Random, 95% CI)	0.95 [0.84, 1.08]
1.2 Cluster-RCTs; post-intervention	2	20124	Rate Ratio (Random, 95% CI)	0.26 [0.22, 0.31]
1.3 Controlled before-and-after trials; pre-intervention	3	97970	Rate Ratio (Random, 95% CI)	1.50 [0.89, 2.52]
1.4 Controlled before-and-after trials; post-intervention	3	98233	Rate Ratio (Random, 95% CI)	0.51 [0.18, 1.44]
2 Parasite prevalence	6		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2.1 Cluster-RCTs; pre-intervention	1	3351	Risk Ratio (M-H, Random, 95% CI)	1.02 [0.66, 1.56]
2.2 Cluster-RCTs; post-intervention	1	2963	Risk Ratio (M-H, Random, 95% CI)	0.11 [0.05, 0.22]
2.3 Controlled before-and-after trials; pre-intervention	5	7480	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.65, 1.52]
2.4 Controlled before-and-after trials; post-intervention	5	8041	Risk Ratio (M-H, Random, 95% CI)	0.32 [0.19, 0.55]
3 Splenomegaly prevalence	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3.1 Controlled before-and-after trials; pre-intervention	2	2569	Risk Ratio (M-H, Random, 95% CI)	0.57 [0.50, 0.65]
3.2 Controlled before-and-after trials; post-intervention	2	2384	Risk Ratio (M-H, Random, 95% CI)	0.11 [0.01, 2.10]

### Analysis 1.1. Comparison 1 Habitat modification alone, Outcome 1 Malaria incidence.

Review: Mosquito larval source management for controlling malaria

Comparison: 1 Habitat modification alone

Outcome: 1 Malaria incidence



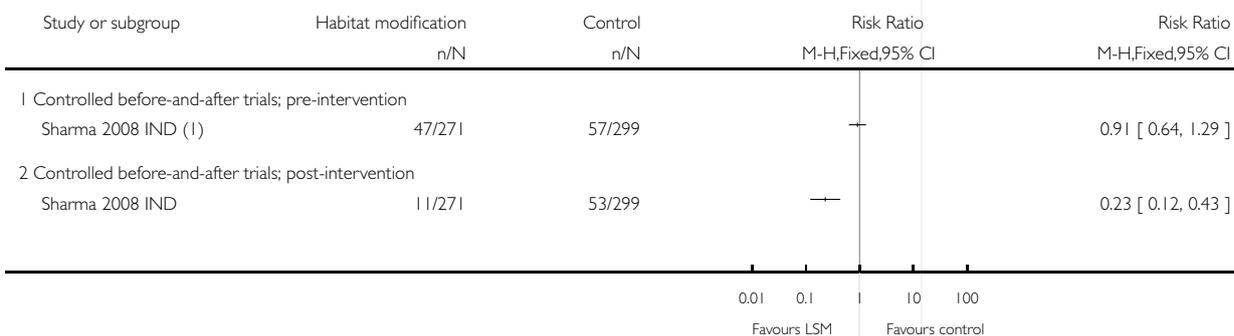
(1) Sharma 2008 IND: Rural, forest setting; larval habitats: streams, stagnant pools, ditches, irrigation channels.

### Analysis 1.2. Comparison 1 Habitat modification alone, Outcome 2 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 1 Habitat modification alone

Outcome: 2 Parasite prevalence



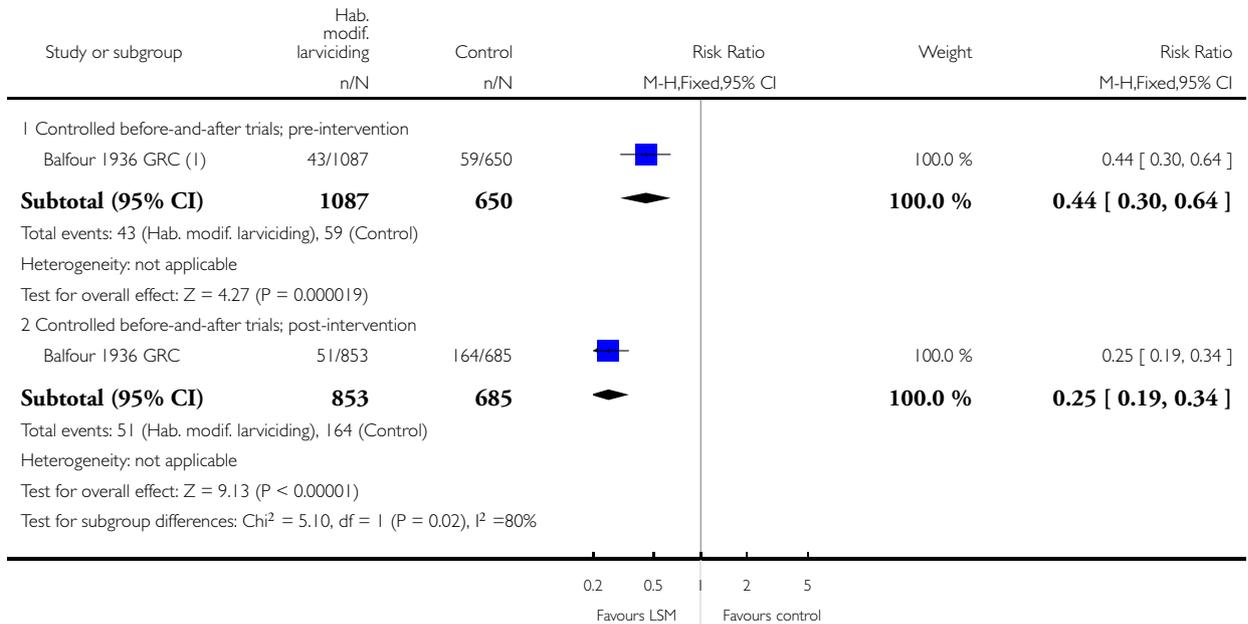
(1) Sharma 2008 IND: Rural, forest setting; larval habitats: streams, stagnant pools, ditches, irrigation channels.

## Analysis 2.1. Comparison 2 Habitat modification with larviciding, Outcome 1 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 2 Habitat modification with larviciding

Outcome: 1 Parasite prevalence



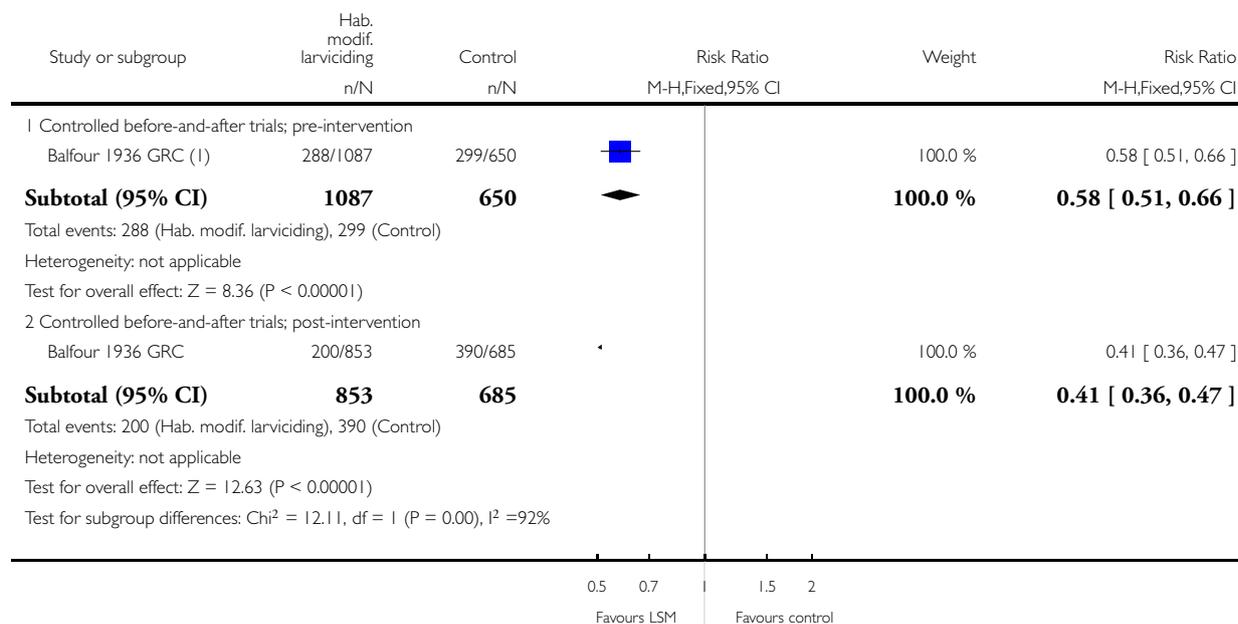
(1) Balfour 1936 GRC: Urban and rural, coastal setting; larval habitats: primarily man-made.

## Analysis 2.2. Comparison 2 Habitat modification with larviciding, Outcome 2 Splenomegaly prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 2 Habitat modification with larviciding

Outcome: 2 Splenomegaly prevalence



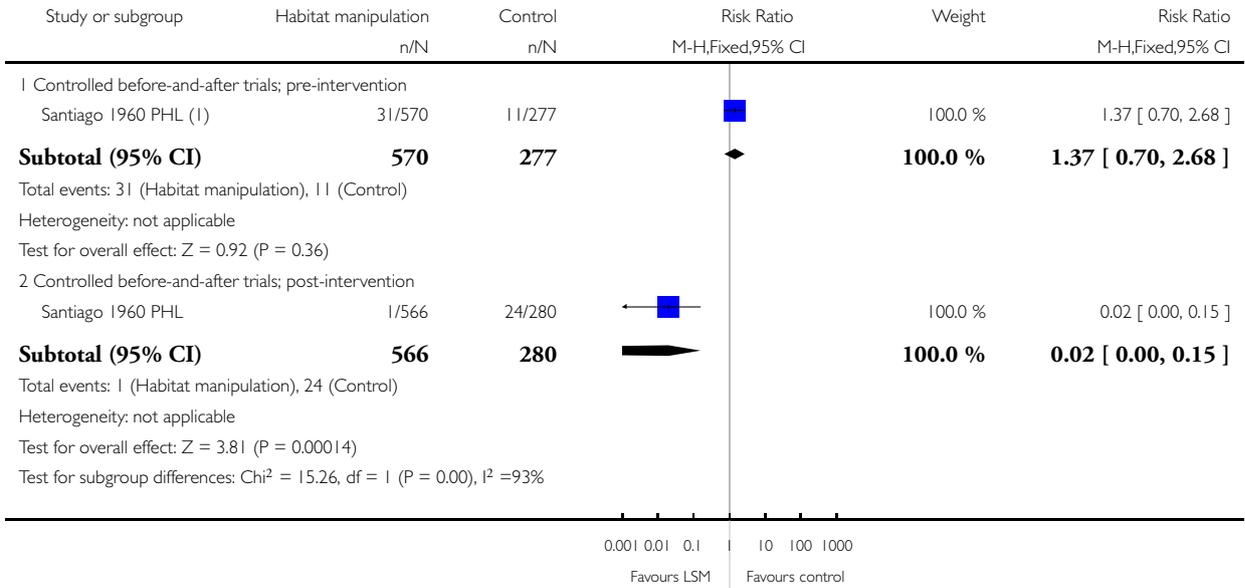
(1) Balfour 1936 GRC: Urban and rural, coastal setting; larval habitats: primarily man-made.

### Analysis 3.1. Comparison 3 Habitat manipulation alone, Outcome 1 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 3 Habitat manipulation alone

Outcome: 1 Parasite prevalence



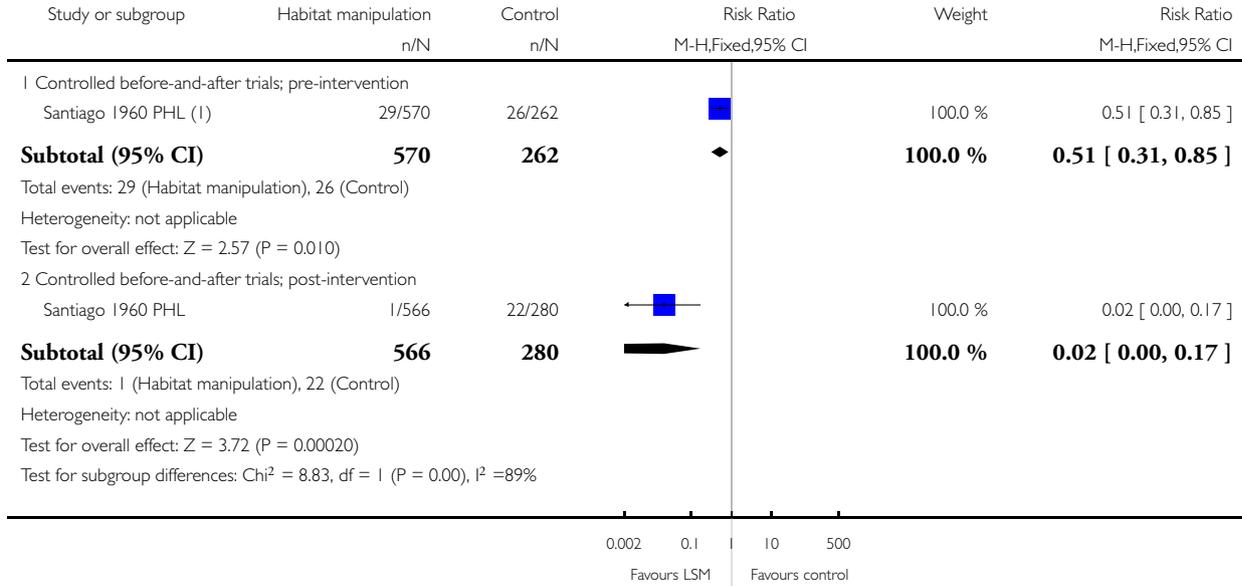
(1) Santiago 1960 PHL: Urban, coastal setting; larval habitats: streams.

### Analysis 3.2. Comparison 3 Habitat manipulation alone, Outcome 2 Splenomegaly prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 3 Habitat manipulation alone

Outcome: 2 Splenomegaly prevalence



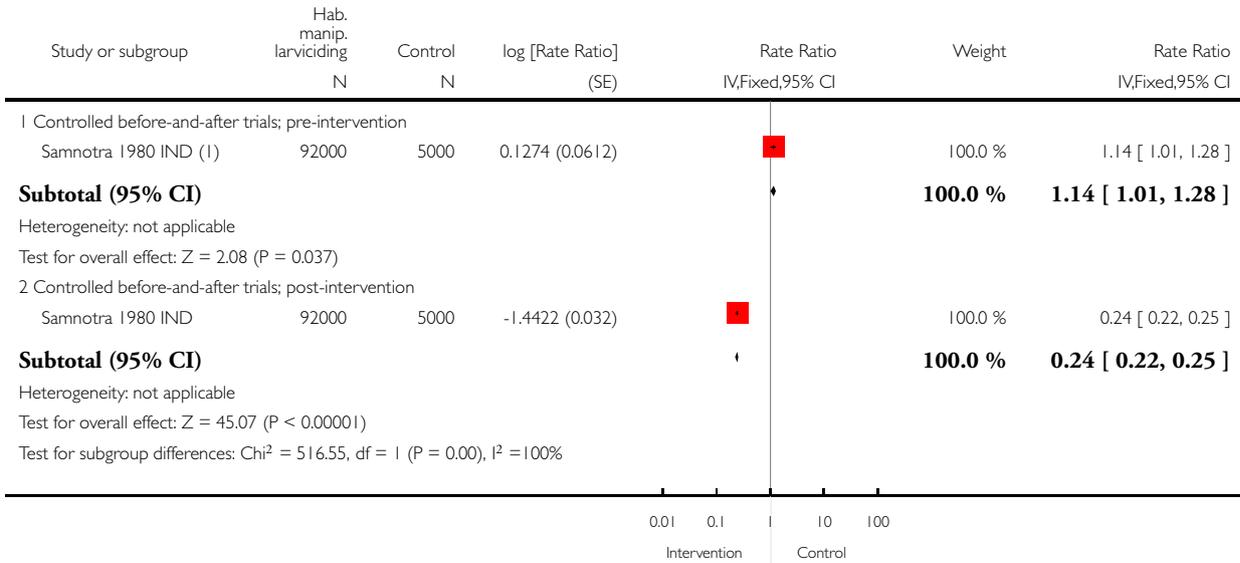
(1) Santiago 1960 PHL: Urban, coastal setting; larval habitats: streams.

### Analysis 4.1. Comparison 4 Habitat manipulation with larviciding, Outcome 1 Malaria incidence.

Review: Mosquito larval source management for controlling malaria

Comparison: 4 Habitat manipulation with larviciding

Outcome: 1 Malaria incidence



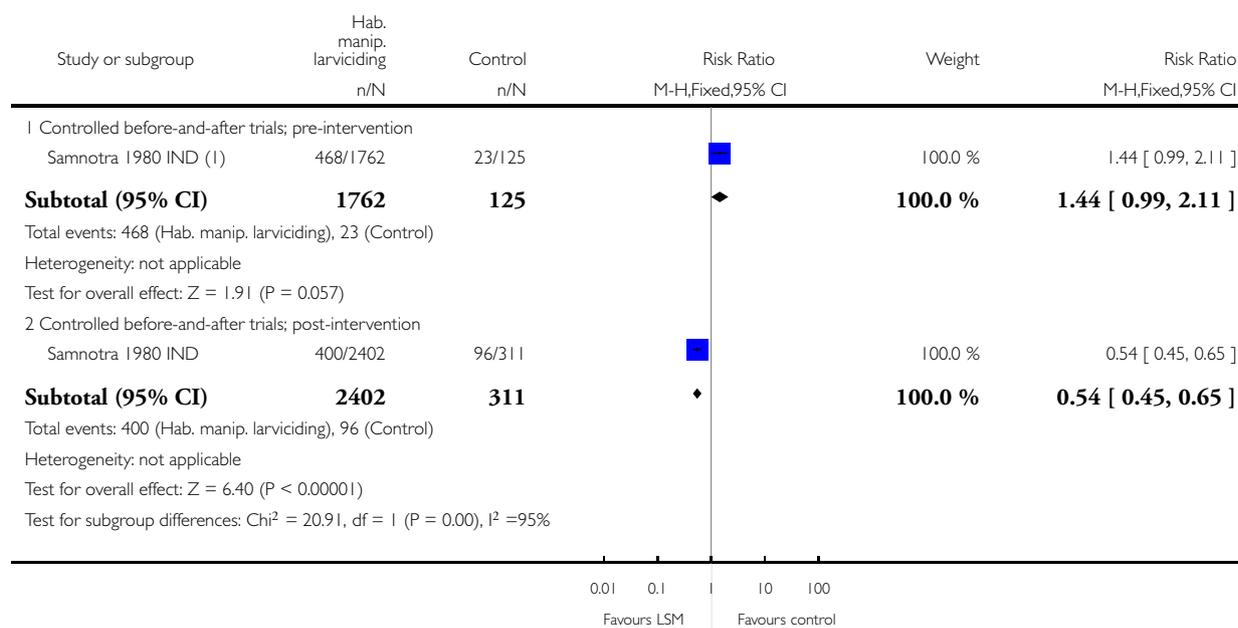
(1) Samnotra 1980 IND: Urban, desert fringe setting; larval habitats: containers, wells, canals.

## Analysis 4.2. Comparison 4 Habitat manipulation with larviciding, Outcome 2 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 4 Habitat manipulation with larviciding

Outcome: 2 Parasite prevalence



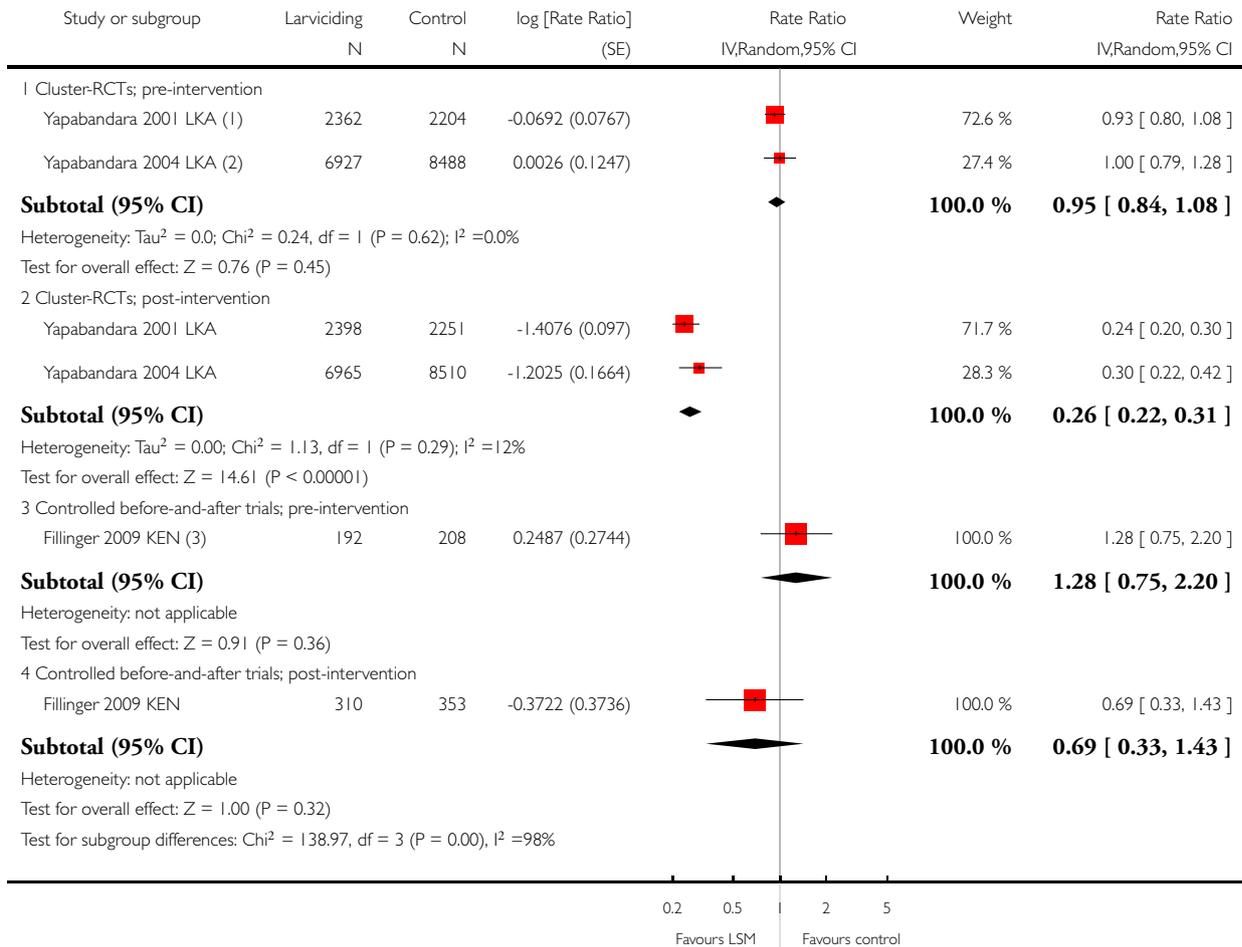
(1) Samnotra 1980 IND: Urban, desert fringe setting; larval habitats: containers, wells, canals.

## Analysis 5.1. Comparison 5 Larviciding alone, Outcome 1 Malaria incidence.

Review: Mosquito larval source management for controlling malaria

Comparison: 5 Larviciding alone

Outcome: 1 Malaria incidence



(1) Yapabandara 2001 LKA: Rural, forested setting; larval habitats: abandoned gem mine pits (No ICC adjustment).

(2) Yapabandara 2004 LKA: Rural, 'dry zone' setting; larval habitats: river bed pools, streams, irrigation ditches, rice paddies (No ICC adjustment).

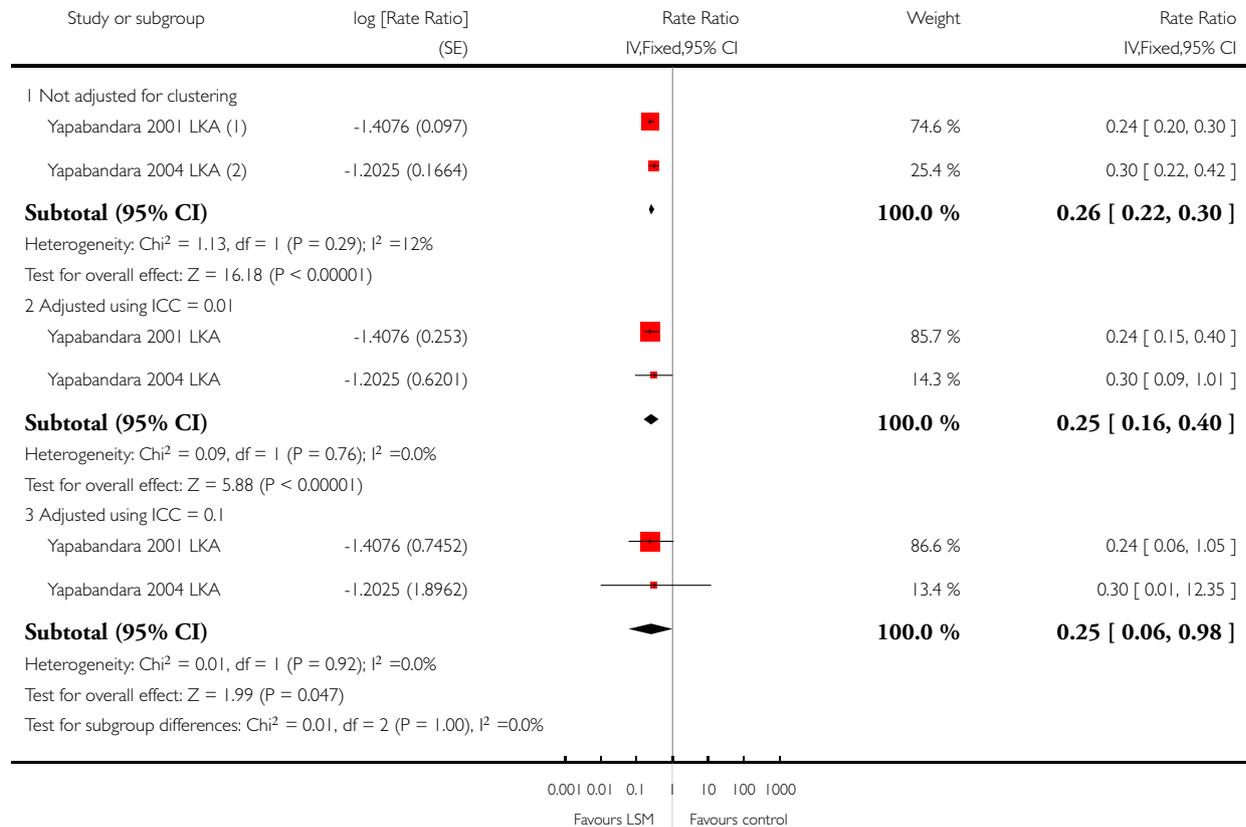
(3) Fillinger 2009 KEN: Rural, highland setting; larval habitats: small streams, papyrus swamps. (Outcome: incidence of infection)

## Analysis 5.2. Comparison 5 Larviciding alone, Outcome 2 Malaria incidence (post-intervention) sensitivity analysis.

Review: Mosquito larval source management for controlling malaria

Comparison: 5 Larviciding alone

Outcome: 2 Malaria incidence (post-intervention) sensitivity analysis



(1) Yapabandara 2001 LKA: Rural, forested setting; larval habitats: abandoned gem mine pits.

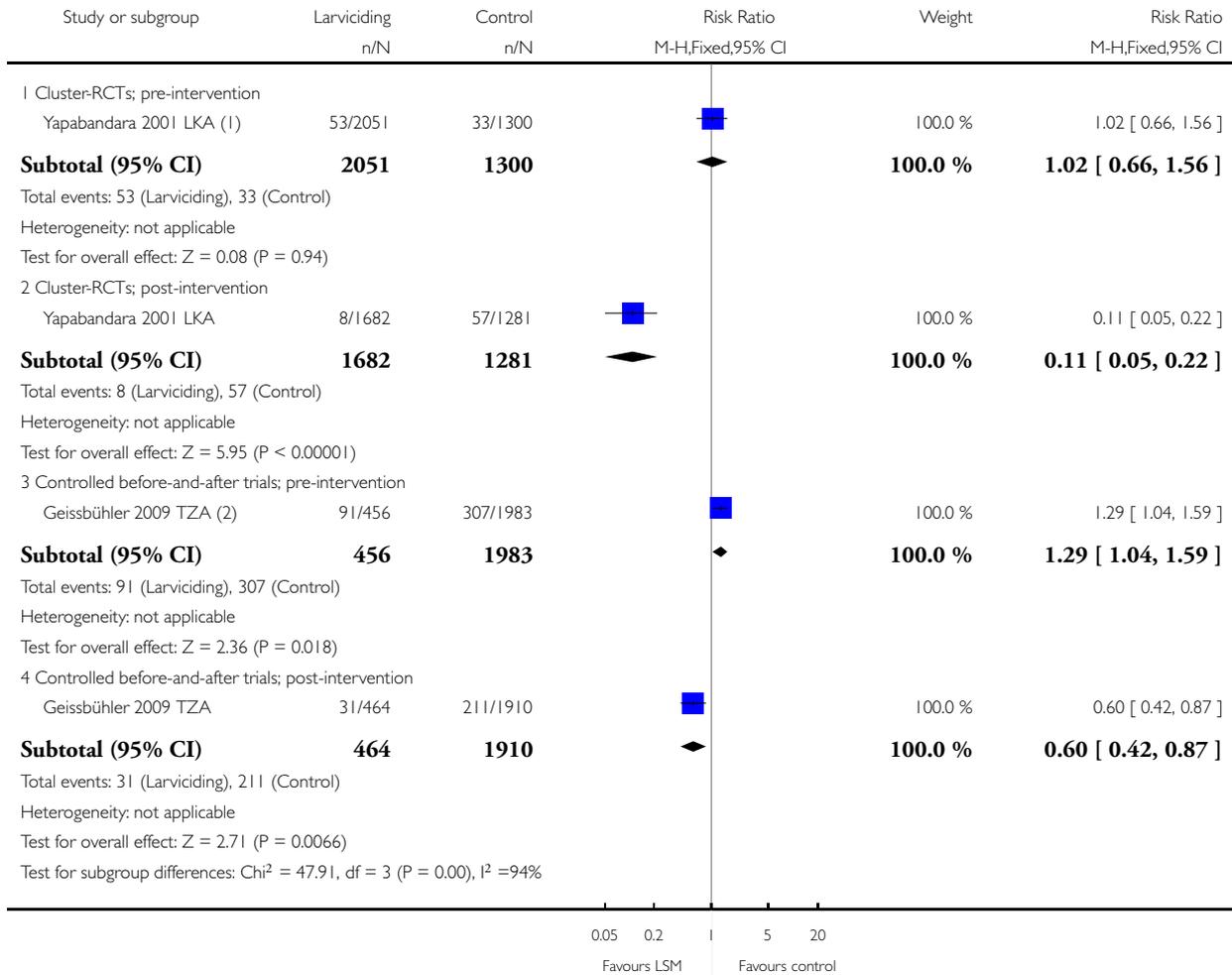
(2) Yapabandara 2004 LKA: Rural, 'dry zone' setting; larval habitats: river bed pools, streams, irrigation ditches, rice paddies.

### Analysis 5.3. Comparison 5 Larviciding alone, Outcome 3 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 5 Larviciding alone

Outcome: 3 Parasite prevalence



(1) Yapabandara 2001 LKA: Rural, forested setting; larval habitats: abandoned gem mine pits (No ICC adjustment).

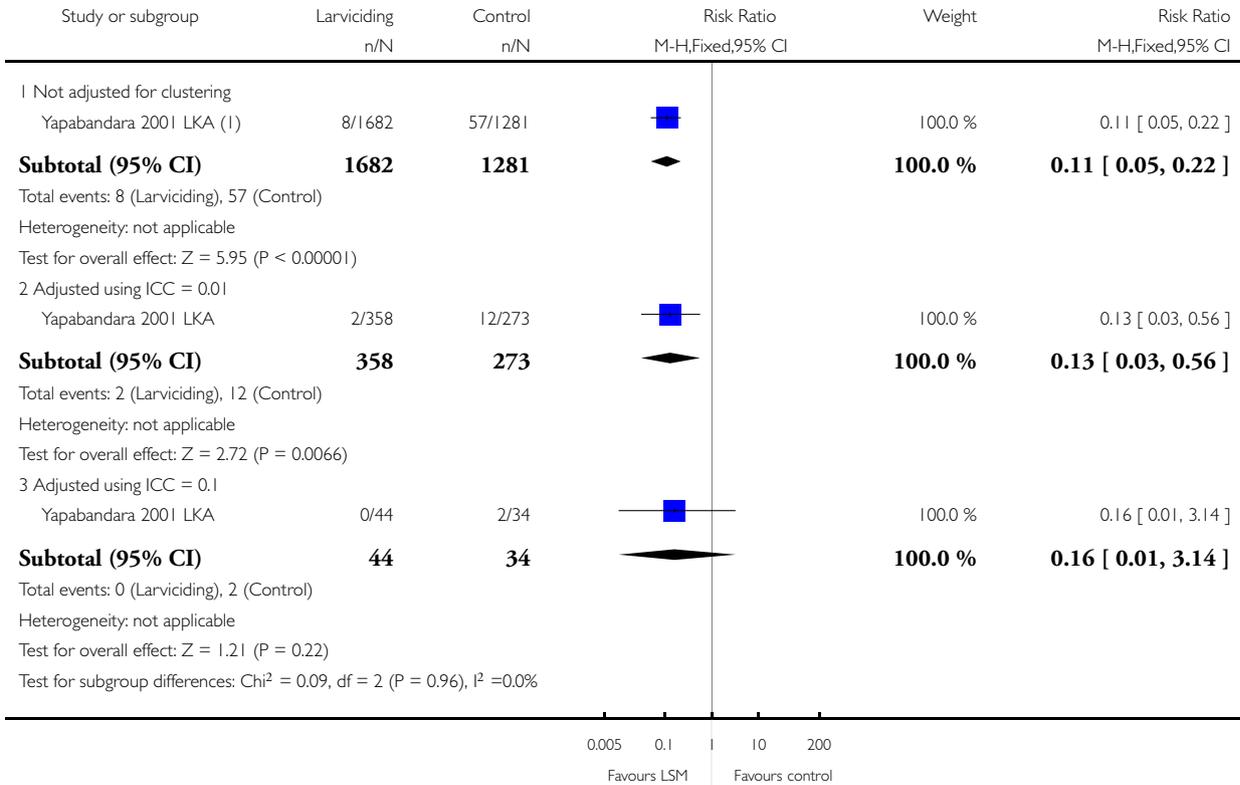
(2) Geissbuhler 2009 TZA: Urban, coastal setting; larval habitats: man-made habitats exposed to sunlight.

**Analysis 5.4. Comparison 5 Larviciding alone, Outcome 4 Parasite prevalence (post-intervention) sensitivity analysis.**

Review: Mosquito larval source management for controlling malaria

Comparison: 5 Larviciding alone

Outcome: 4 Parasite prevalence (post-intervention) sensitivity analysis



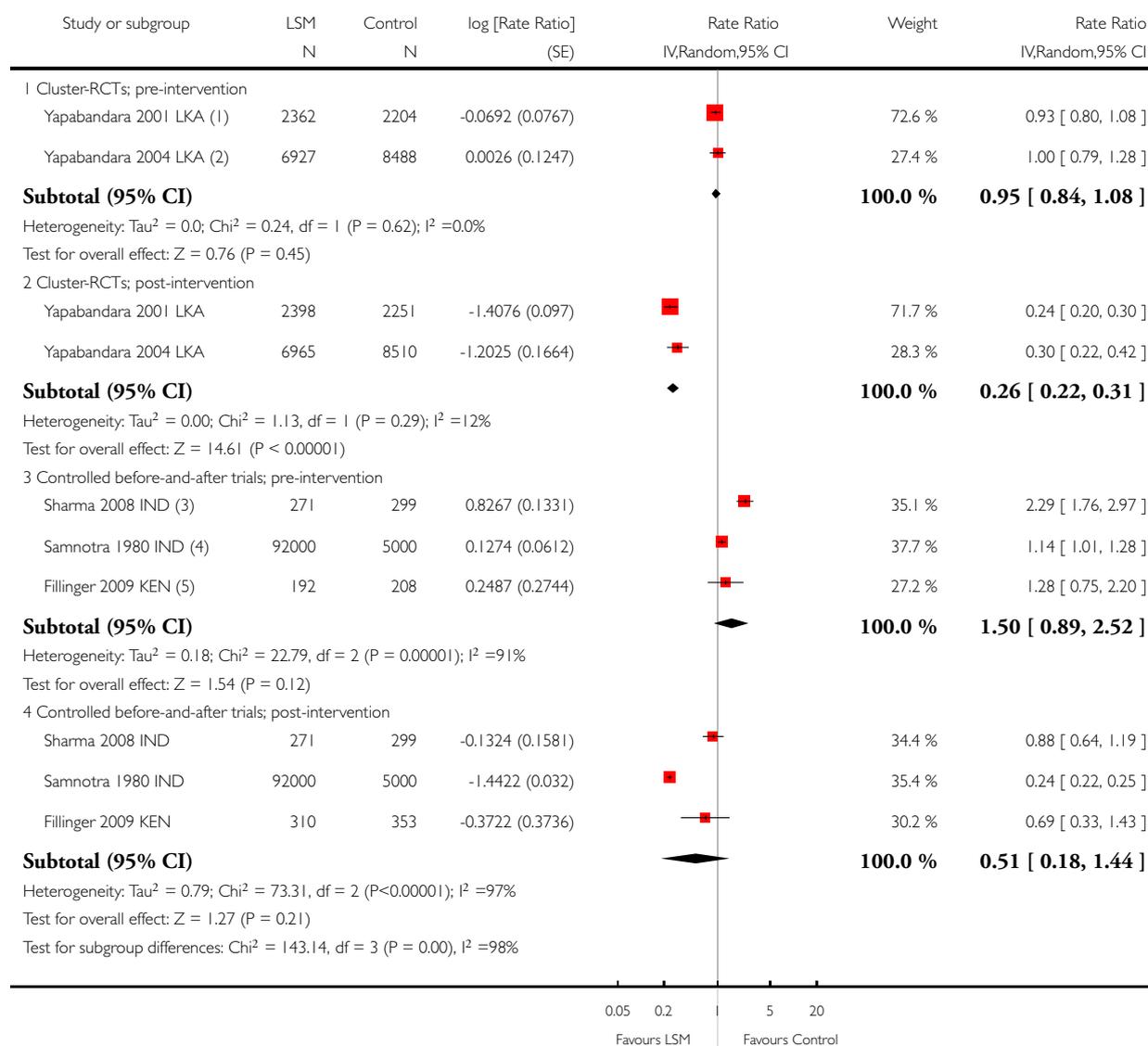
(1) Yapabandara 2001 LKA: Rural, forested setting; larval habitats: abandoned gem mine pits.

## Analysis 6.1. Comparison 6 Larval source management versus control, Outcome 1 Malaria incidence.

Review: Mosquito larval source management for controlling malaria

Comparison: 6 Larval source management versus control

Outcome: 1 Malaria incidence



(1) Yapabandara 2001 LKA: Larviciding; rural, forested setting; larval habitats: abandoned gem mine pits.

(2) Yapabandara 2004 LKA: Larviciding; rural, 'dry zone' setting; larval habitats: river bed pools, streams, irrigation ditches, rice paddies.

(3) Sharma 2008 IND: Habitat modification; rural, forest setting; larval habitats: streams, stagnant pools, ditches, irrigation channels.

(4) Samnotra 1980 IND: Habitat manipulation with larviciding; urban, desert fringe setting; larval habitats: containers, wells, pools, canals.

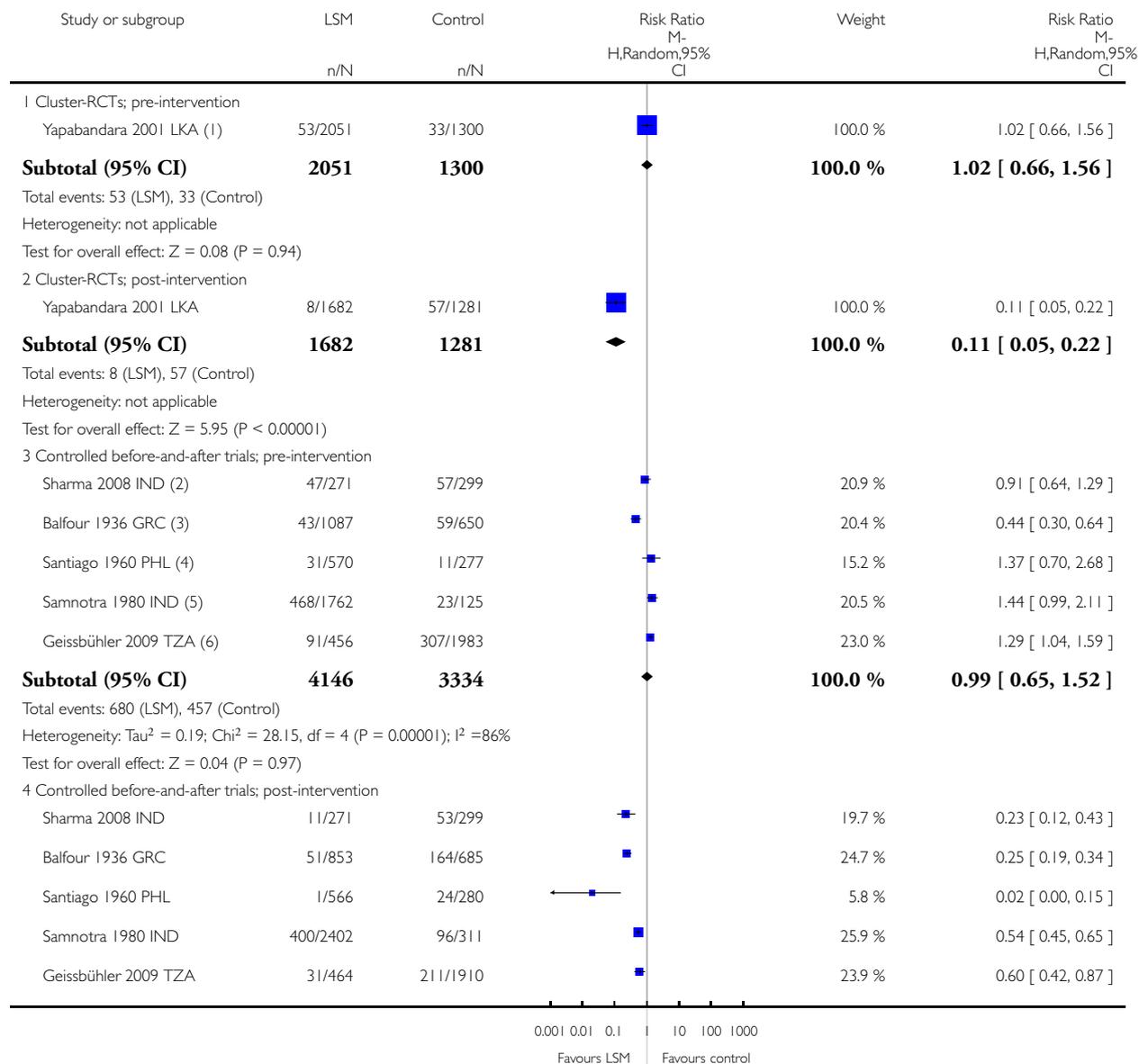
(5) Fillinger 2009 KEN: Larviciding; rural, highland setting; larval habitats: small streams, papyrus swamps.

## Analysis 6.2. Comparison 6 Larval source management versus control, Outcome 2 Parasite prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 6 Larval source management versus control

Outcome: 2 Parasite prevalence



(Continued ...)

(... Continued)

Study or subgroup	LSM n/N	Control n/N	Risk Ratio M- H,Random,95% CI	Weight	Risk Ratio M- H,Random,95% CI
<b>Subtotal (95% CI)</b>	<b>4556</b>	<b>3485</b>	<b>◆</b>	<b>100.0 %</b>	<b>0.32 [ 0.19, 0.55 ]</b>
Total events: 494 (LSM), 548 (Control)					
Heterogeneity: Tau <sup>2</sup> = 0.29; Chi <sup>2</sup> = 37.17, df = 4 (P<0.00001); I <sup>2</sup> =89%					
Test for overall effect: Z = 4.11 (P = 0.000040)					
Test for subgroup differences: Chi <sup>2</sup> = 37.36, df = 3 (P = 0.00), I <sup>2</sup> =92%					

0.001 0.01 0.1 | 10 100 1000  
Favours LSM Favours control

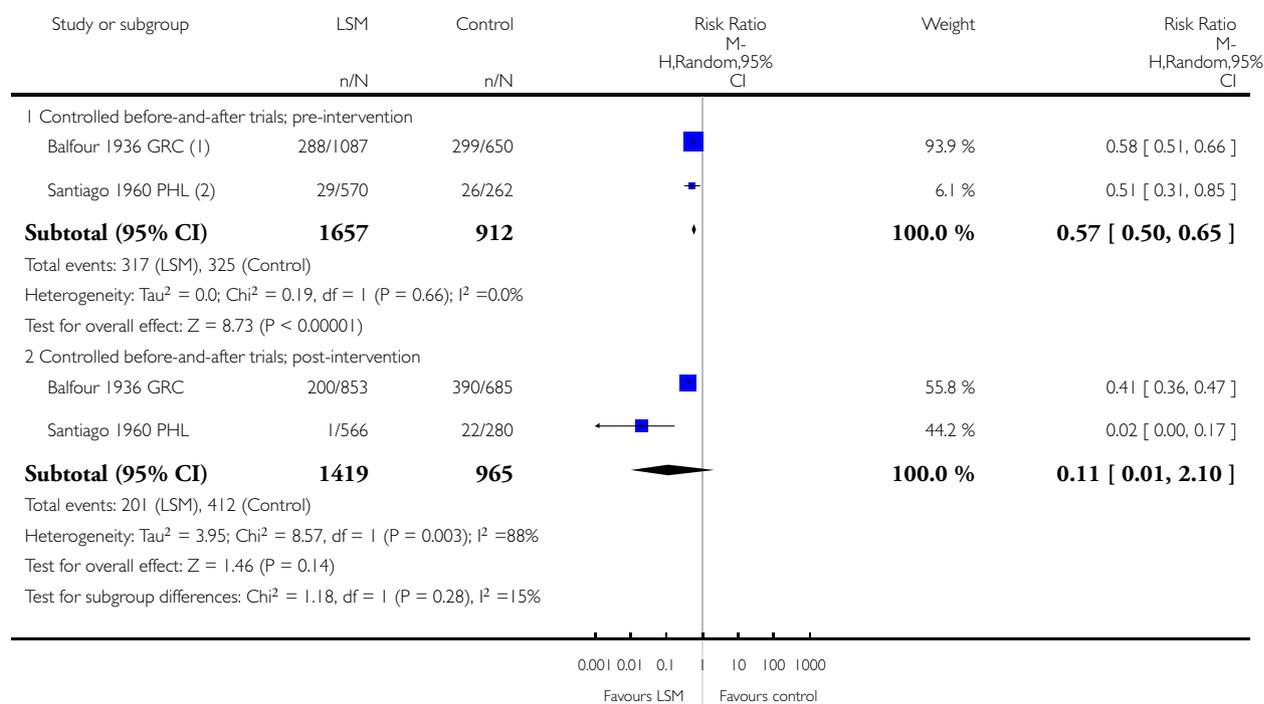
- (1) Yapabandara 2001 LKA: Larviciding; rural, forested setting; larval habitats: abandoned gem mine pits.
- (2) Sharma 2008 IND: Habitat modification; rural, forest setting; larval habitats: streams, stagnant pools, ditches, irrigation channels.
- (3) Balfour 1936 GRC: Habitat modification with larviciding; urban and rural, coastal setting; larval habitats: primarily man-made.
- (4) Santiago 1960 PHL: Habitat manipulation; urban, coastal setting; larval habitats: streams.
- (5) Samnotra 1980 IND: Habitat manipulation with larviciding; urban, desert fringe setting; larval habitats: containers, wells, canals.
- (6) Geissbuhler 2009 TZA: Larviciding; urban, coastal setting; larval habitats: man-made habitats exposed to sunlight.

### Analysis 6.3. Comparison 6 Larval source management versus control, Outcome 3 Splenomegaly prevalence.

Review: Mosquito larval source management for controlling malaria

Comparison: 6 Larval source management versus control

Outcome: 3 Splenomegaly prevalence



(1) Balfour 1936 GRC: Habitat modification with larviciding; urban and rural, coastal setting; larval habitats: primarily man-made.

(2) Santiago 1960 PHL: Habitat manipulation; urban, coastal setting; larval habitats: streams.

## ADDITIONAL TABLES

Table 1. Assessment of risk of bias

Risk of bias component	Low	High	Unclear
<b>Sequence generation</b>	Random component in the sequence generation process is described	Non-random method is used.	No or unclear information reported.
<b>Allocation concealment</b>	Patients and investigators could not foresee assignment.	Patients and investigators could foresee assignment.	No or unclear information reported.

**Table 1. Assessment of risk of bias** (Continued)

<b>Blinding (performance)</b>	Performance bias due to knowledge of the allocated interventions by participants and personnel during the study	No evidence of performance bias due to knowledge of the allocated interventions by participants and personnel during the study	No or unclear information reported.
<b>Blinding (detection)</b>	Primary outcomes assessed blinded.	Primary outcomes not assessed blinded.	No or unclear information reported.
<b>Incomplete outcome data</b>	No or low missing data, reason for missing data is unlikely to be related to the true outcome, or missing data is balanced across groups	High missing data, reason for missing data is likely to be related to the true outcome, or missing data is unbalanced across groups	No or unclear information reported.
<b>Selective outcome reporting</b>	All pre-specified outcomes are reported (expected or see protocol)	Not all pre-specified outcomes are reported; or additional outcomes reported	No or unclear information reported.
<b>Recruitment bias</b>	No change in size or number of clusters after randomization.	Possible change in size or number of clusters after randomization	No or unclear information reported.
<b>Baseline characteristics</b>	If baseline characteristics of the study and control areas are reported and similar	If there are differences between control and intervention areas	No or unclear information reported.
<b>Contamination</b>	it is unlikely that the control group received the intervention	It is likely that the control group received the intervention	No or unclear information reported.
<b>Incorrect analysis (Randomized studies only)</b>	Randomized studies: clustering taken into account in analysis	Randomized studies: clustering not taken into account in analysis	Randomized studies: No or unclear information reported.
<b>Other biases (confounding)</b>	Non-randomized studies: no evidence of confounding (selection bias)	Non-randomized studies: evidence of confounding (selection bias)	Non-randomized studies: no or unclear information reported.

**Table 2. Summary of interventions and eco-epidemiological settings**

Intervention	Study ID	Study design	Details of the intervention	Who was responsible for LSM?	Ecosystem	Primary vectors (primary larval habitats)	Malaria transmission intensity
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**Table 2. Summary of interventions and eco-epidemiological settings** (Continued)

<b>Habitat modification alone</b>	<a href="#">Sharma 2008 IND</a>	Controlled before-and-after	Dam construction	Community, government	Forest; rural	<i>An. fluviatilis</i> (streams), <i>An. culicifacies</i> (stagnant pools, ditches, irrigation channels)	Moderate
<b>Habitat modification with larviciding</b>	<a href="#">Shililu 2007 ERI</a>	Cluster-RCT	Land filling and grading; drainage; larviciding with synthetic organic compounds and microbials	Study staff, community	Desert fringe, highland and lowland; rural	<i>An. arabiensis</i> (stream bed pools, canals, drainage channels, wells, communal water supply points)	Not stated
	<a href="#">Balfour 1936 GRC</a>	Controlled before-and-after	Straightening, deepening and lining of natural streams; drainage; larviciding with Paris Green	Government	Coastal; urban and rural	<i>An. elutus</i> ; <i>An. superpictus</i> (primarily man-made habitats)	Low to moderate
<b>Habitat manipulation alone</b>	<a href="#">Santiago 1960 PHL</a>	Controlled before-and-after	Controlling water levels and stream flushing		Coastal; urban	<i>An. minimus flavirostris</i> (streams fed by a lake)	High
<b>Habitat manipulation with larviciding</b>	<a href="#">Castro 2009 TZA</a>	Controlled before-and-after	Clearing of aquatic vegetation and debris; larviciding with microbials	Study staff, community, government	Coastal; urban	<i>An. gambiae</i> , <i>An. funestus</i> (drains)	Low to moderate
	<a href="#">Samnotra 1980 IND</a>	Controlled before-and-after	Removal of 'domestic' larval habitats; Larviciding with synthetic organic compounds	Study staff, community	Desert fringe; urban	<i>An. culicifacies</i> , <i>An. stephensi</i> (containers, wells, rainwater pools, canals, stagnant pools in drains)	Low
<b>Larviciding alone</b>	<a href="#">Coulibaly 2011 MLI</a>	Cluster-RCT	Larviciding with microbials	Study staff, community	Savannah; rural	<i>An. gambiae</i> (brick pits, ponds,	High

**Table 2. Summary of interventions and eco-epidemiological settings** (Continued)

						tyre prints)	
<a href="#">Yapabandara 2001 LKA</a>	Cluster-RCT	Larviciding with insect growth regulators	Study staff, community	Forest; rural	<i>An. culicifacies</i> , <i>An. subpictus</i> Grassi. (abandoned gem mine pits)	Moderate to high	
<a href="#">Yapabandara 2004 LKA</a>	Cluster-RCT	Larviciding with insect growth regulators	Study staff	'Dry zone'; rural	<i>An. culicifacies</i> , <i>An. subpictus</i> (river bed pools, streams, irrigation ditches (dry season); rice paddies (rainy season))	Moderate	
<a href="#">Fillinger 2008 TZA</a>	Controlled before-and-after	Larviciding with microbials	Study staff, community	Coastal; urban	<i>An. gambiae</i> s. s., <i>An. arabiensis</i> (man-made habitats exposed to sunlight)	Low to moderate	
<a href="#">Fillinger 2009 KEN</a>	Controlled before-and-after	Larviciding with microbials	Study staff	Highland; rural	<i>An. gambiae</i> s. l., <i>An. funestus</i> s.l. (small streams, papyrus swamps)	Moderate	
<a href="#">Geissbühler 2009 TZA</a>	Controlled before-and-after	Larviciding with microbials	Study staff, community	Coastal; urban	<i>An. gambiae</i> s. l. (man-made habitats exposed to sunlight)	Low to moderate	
<a href="#">Majambere 2010 GMB</a>	Randomized cross-over	Larviciding with microbials	Study staff, community	Savannah; rural	<i>An. gambiae</i> (flood plains, rice paddy fields)	High	

**Table 3. Summary of original data for Balfour 1936 GRC**

Outcome	Group	Parasite or splenomegaly prevalence (total positive/total examined)					
		Pre-intervention		Post-intervention			
		1930	1931	1932	1933	1934	1935
Parasite prevalence	Control	9.1% (59/650)	23.9% (164/685)	15.0% (104/692)	21.9% (147/670)	10.0% (69/690)	18.0% (123/682)
	Treatment	4.0% (43/1087)	6.0% (51/853)	9.0% (75/837)	4.0% (33/830)	1.0% (8/834)	1.6% (13/827)
Splenomegaly prevalence	Control	46.0% (299/650)	56.9% (390/685)	43.1% (298/692)	44.0% (295/670)	35.9% (248/690)	40.0% (273/682)
	Treatment	26.5% (288/1087)	23.4% (200/853)	18.0% (151/837)	13.0% (108/830)	12.0% (100/834)	7.0% (58/827)

**Table 4. Entomological data: Adult mosquito density (density measures other than human biting rate)**

Intervention	Study ID	Study design	Mean adult mosquito density (95% CI)				Percent reduction (95% CI) <sup>1</sup>	Notes
			Pre-intervention		Post-intervention			
			Control	Treatment	Control	Treatment		
Habitat modification with larviciding	<a href="#">Shililu 2007 ERI</a>	Cluster-RCT	-	-	4.99	4.23	15.2	Mean number of female adult anophelines per night (light traps)
Habitat manipulation alone	<a href="#">Santiago 1960 PHL</a>	Controlled before-and-after trial	0.15	0.20	0.17	0.02	91.2	Mean number of adult anophelines per catching station (human-baited traps)
Habitat manipulation with	<a href="#">Samnotra 1980 IND</a>	Controlled before-and-after trial	222	702	696	213	90.3	Mean number of adult

**Table 4. Entomological data: Adult mosquito density (density measures other than human biting rate) (Continued)**

larviciding									anophelines per catching station (resting catch)
Larviciding alone	Coulibaly 2011 MLI (2009 data)	Cluster-RCT	-	-	2.27	1.49	34.4	-	
	Coulibaly 2011 MLI (2010 data)	Cluster-RCT	-	-	6.03	3.75	37.8	-	
	Yapabandara 2001 LKA	Cluster-RCT	16.88	27.63	22.13	3.38	90.7		Mean number of adult anophelines per man per night (partial night human landing catches) ( <i>An. culicifacies</i> )
	Yapabandara 2001 LKA <sup>2</sup>	Cluster-RCT	-	-	-	-	-		Mean number of adult anophelines per man per night (all night human landing catches) ( <i>An. culicifacies</i> )
	Yapabandara 2004 LKA	Cluster-RCT	6.64	9.11	8.75	1.44	88.0		Mean resting density of adult anophelines (cattle baited huts) ( <i>An. culicifacies</i> )
	Fillinger 2009 KEN	Controlled before-and-after trial	3.69 (2.25 to 6.06)	3.49 (2.49 to 4.88)	0.60 (0.45 to 0.79)	0.08 (0.06 to 0.13)	85.9 (68.3 to 93.7)		Mean number adult anophelines per house



**Table 5. Summary of additional results for Majambere 2010 GMB (clinical data) (Continued)**

3	-	-	6.5% (29/447)	2.6% (12/455)	2.46 (1.27 to 4.76)
4	5.8% (25/434)	3.8% (18/471)	-	-	0.66 (0.37 to 1.20)

<sup>1</sup> Total cases (95% CI) per 100 person years at risk; rate ratio.

<sup>2</sup> Parasite prevalence (total positive / total examined); risk ratio.

<sup>3</sup> Splenomegaly prevalence (total positive / total examined); risk ratio.

**Table 6. Summary of additional results for Majambere 2010 GMB (entomological data)**

Outcome	Zone	Density or rate					Percent reduction across all zones
		Pre-intervention year (2005)	Post-intervention				
			Control year (2006)	Treatment year (2007)	Treatment year (2006)	Control year (2007)	
Adult mosquito density (measures other than human biting rate) <sup>1</sup>	1	3 (0 to 7)	-	-	1 (0 to 3)	2 (0 to 5)	11.3 (-217.6 to 75.2)
	2	19 (4 to 44)	13 (6 to 26)	13 (4 to 26)	-	-	
	3	24 (6 to 78)	-	-	12 (4 to 31)	34 (10 to 69)	
	4	11 (3 to 26)	3 (1 to 11)	9 (2 to 26)	-	-	
EIR <sup>2</sup>	1	8.80	-	-	0.00	2.24	17.6 (-376.1 to 85.7)
	2	8.29	0.00	2.32	-	-	
	3	16.55	-	-	5.82	17.00	
	4	6.13	3.13	3.91	-	-	

<sup>1</sup> Median female *An. gambiae* / trap / night (interquartile range).

<sup>2</sup> Seasonal EIR.

<sup>3</sup> Overall percent reduction calculated using difference in differences method (see [Data synthesis](#)).

**Table 7. Entomological data: EIR**

Intervention	Study ID	Study design	EIR (95% CI)				Percent reduction (95% CI) <sup>1</sup>	Notes
			Pre-intervention		Post-intervention			
			Control	Treatment	Control	Treatment		

**Table 7. Entomological data: EIR** (Continued)

Larviciding alone	<a href="#">Coulibaly 2011 MLI (2009 data)</a>	Cluster-RCT	-	-	0.00	0.18	Not estimable	Monthly EIR
	<a href="#">Coulibaly 2011 MLI (2010 data)</a>	Cluster-RCT	-	-	2.92	0.45	84.6	Monthly EIR
	<a href="#">Fillinger 2008 TZA</a>	Controlled before-and-after trial	1.05 (0.68 to 1.65)	0.81 (0.58 to 1.15)	1.06 (0.64 to 1.77)	0.56 (0.43 to 0.77)	31.5 (-59.4 to 70.6)	Annual EIR ( <i>An. gambiae</i> )
	<a href="#">Fillinger 2009 KEN</a>	Controlled before-and-after trial	11.98 (7.39 to 19.40)	10.30 (7.20 to 14.95)	1.68 (1.16 to 2.42)	0.39 (0.19 to 0.79)	73.0 (22.0 to 90.7)	Annual EIR
	<a href="#">Geissbühler 2009 TZA</a>	Controlled before-and-after trial	1.44 (1.14 to 1.81)	1.18 (0.80 to 1.73)	1.24 (0.97 to 1.57)	0.80 (0.60 to 1.06)	21.3 (-42.3 to 56.4)	Annual EIR

<sup>1</sup>Where pre- and post-intervention data are reported, percent reduction was calculated by difference in differences method (see [Methods](#)). Where post-intervention data only were reported, percent reduction was calculated as: 1 - (mean density in treatment group/mean density in control group).

**Table 8. Entomological data: Adult mosquito density (human biting rate)**

Intervention	Study ID	Study design	Human biting rate (95% CI)				Percent reduction (95% CI) <sup>1</sup>	Notes
			Pre-intervention		Post-intervention			
			Control	Treatment	Control	Treatment		
Larviciding alone	<a href="#">Coulibaly 2011 MLI (2009 data)</a>	Cluster-RCT	-	-	16.40	8.37	49.0	Mean number of bites per person per month
	<a href="#">Coulibaly 2011 MLI (2010 data)</a>	Cluster-RCT	-	-	41.40	22.43	45.8	Mean number of bites per person per month
	<a href="#">Fillinger 2008 TZA</a>	Controlled before-and-after trial	0.93 (0.60 to 1.46)	0.72 (0.51 to 1.02)	0.94 (0.57 to 1.56)	0.50 (0.38 to 0.68)	31.3 (-59.2 to 70.4)	Mean number of bites per person

**Table 8. Entomological data: Adult mosquito density (human biting rate)** (Continued)

										per year ( <i>An. gambiae</i> )
	Fillinger 2009 KEN	Controlled before-and- after trial	0.45 (0.28 to 0.73)	0.39 (0.27 to 0.56)	0.06 (0.04 to 0.09)	0.014 (0.006 to 0. 028)	73.1 (20.3 to 90. 9)			Mean number of blood fed female anophelines per person per sampling date

<sup>1</sup> Where pre- and post-intervention data were reported, percent reduction was calculated by difference in differences method (see [Methods](#)). Where post-intervention data only were reported, percent reduction was calculated as: 1 - (mean density in treatment group/mean density in control group).

## APPENDICES

### Appendix I. Methods of the review: detailed search strategies

Search set	CIDG SR <sup>1</sup>	CENTRAL	MEDLINE	EMBASE	LILACS	CABS Abstracts
1	Mosquito*	Malaria [Mesh]	Malaria [Mesh]	Malaria [Emtree]	Mosquito*	Mosquito*
2	Anopheles	Anopheles {Mesh}	Anopheles ti, ab, Mesh	Anopheles ti, ab, Emtree	Anopheles	Anopheles
3	1 or 2	Mosquito* ti, ab	Mosquito* ti, ab	Mosquito* ti, ab	1 or 2	1 or 2
4	malaria	2 or 3	2 or 3	2 or 3	malaria	malaria
5	3 and 4	1 and 4	1 and 4	1 and 4	3 and 4	3 and 4
6	control	Mosquito control [Mesh]	Mosquito control [Mesh]	Mosquito control ti, ab	control	control
7	Larvicid*	Larvicid* ti, ab	Larvicid* ti, ab	Larvicid* ti, ab	Larvicid*	Larvicid*
8	Manag*	Larval control ti, ab	Larval control ti, ab	Larval control ti, ab	Manag*	Manag*

(Continued)

9	6 or 7 or 8	6 or 7 or 8	Bacillus thuringiensis ti, ab	Bacillus thuringiensis ti, ab	6 or 7 or 8	Bacillus thuringiensis
10	5 and 9	5 and 9	Bacillus sphericus ti, ab	Bacillus sphericus ti, ab	5 and 9	Bacillus sphericus
11			Paris green ti, ab, sn	Paris green ti, ab		Paris green
12			Temefos ti, ab, sn	Temefos ti, ab		Temefos
13			Pyriproxyfen ti, ab	Pyriproxyfen ti, ab		Pyriproxyfen
14			pirimiphos-methyl ti, ab	pirimiphos-methyl ti, ab		pirimiphos-methyl
15			Juvenile hormones [mesh]	Insect growth regulator* ti, ab		Insect growth regulator*
16			Insect growth regulator* ti, ab	Environmental management ti, ab, Emtree		Environmental management
17			Environmental management ti, ab	Habitat modification ti, ab		Habitat modification
18			Habitat modification ti, ab	Biological pest control [Emtree]		Biological pest control
19			Pest Control, Biological [Mesh]	6-18/OR		6-18/OR
20			6-19/or	5 and 19		5 and 19
21			5 and 20			

<sup>1</sup>Cochrane Infectious Diseases Group Specialized Register

## CONTRIBUTIONS OF AUTHORS

Lucy Tusting assisted with article retrieval, reviewed search results, extracted and analyzed the data, and prepared the review. Julie Thwing coordinated protocol preparation, assisted with article retrieval, reviewed search results, extracted the data and assisted with preparing the review. Kimberly Bonner reviewed search results and extracted data. Christian Bottomley analyzed the data. David Sinclair analyzed the data and prepared the review. Ulrike Fillingner assisted with writing the protocol and edited the final version of the manuscript. John Gimnig assisted with protocol preparation and assisted with article retrieval, eligibility assessment and risk of bias assessment, and edited the final version of the manuscript. Steve Lindsay was involved in the conception of this review, assisted with writing the protocol, article retrieval, eligibility assessment, data abstraction, and prepared the review.

## DECLARATIONS OF INTEREST

Ulrike Fillinger, John Gimnig and Steve Lindsay have been the primary investigators and authors of studies that were reviewed. They did not review their own studies. Ulrike Fillinger, Steve Lindsay and Lucy Tusting have received financial support from Valent BioSciences Corporation, USA, a manufacturer of microbial larvicides. Valent BioSciences Corporation had no involvement in the data analysis or preparation of the final report. We have no other interests to disclose.

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### Internal sources

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Translation of foreign language papers

- London School of Hygiene and Tropical Medicine Library and Archives, UK.
- Centers for Disease Control and Prevention Library Services, USA.

### External sources

- Paul Garner, Sarah Donegan, Anne-Marie Stephani, UK.

Cochrane Infectious Diseases Group (guidance on data abstraction, analysis and write-up; comments on the manuscript)

- Tomas Allen, Carole Modis and Marie Sarah Villemin Partow, Switzerland.

WHO Library and Archives, Geneva (retrieval of literature)

- Christianne Esparza, UK.

Cochrane Infectious Diseases Group (retrieval of literature)

- Roll Back Malaria Larval Source Management Work Stream, Switzerland.

## DIFFERENCES BETWEEN PROTOCOL AND REVIEW

### Types of studies

We planned to include uncontrolled interrupted time series and before-and-after trials in which LSM was the only intervention introduced during the study period. However, we found these trials were too susceptible to bias introduced by confounding factors, such as natural fluctuations in vector populations and climate.

### Conference proceedings

We intended to search the conference proceedings of the MIM Pan-African Malaria Conferences, the American Society of Tropical Medicine and Hygiene, the American Mosquito Control Association and the Society for Vector Ecology for relevant abstracts. However, we did not do this.

### Data extraction for cluster-RCTs

Where results were adjusted for clustering, we planned to extract a point estimate and report the 95% confidence interval (CI). However, none of the RCTs we included adjusted for clustering.

**Assessment of heterogeneity**

To assess heterogeneity, we planned to inspect the forest plots and to implement the  $I^2$  statistic with the following definitions of heterogeneity: heterogeneity might not be important (0% to 40%); moderate heterogeneity (30% to 60%); substantial heterogeneity (50% to 90%); or considerable heterogeneity (75% to 100%). We planned to use  $P = 0.1$  as the threshold for statistical significance. However, we did not identify a sufficient number of studies (10 trials or more).

**Subgroup analysis and investigation of heterogeneity**

Where trials were combined in meta-analysis, we planned to conduct subgroup analyses to investigate heterogeneity in the effect of LSM across eco-epidemiological settings. However we did not identify a sufficient number of trials.

**Assessment of reporting biases**

We planned to construct funnel plots to look for evidence of publication bias but we did not identify a sufficient number of trials (10 trials or more).

**Changes to author list**

We added Lucy Tusting, Kimberley Bonner, Christian Bottomley and David Sinclair as authors. Robert Newman left the author team.