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Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria (Review)

Augustincic Polec L, Petkovic J, Welch V, Ueffing E, Tanjong Ghogomu E, Pardo Pardo J, Grabowsky M, Attaran A, Wells GA, Tugwell P

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Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria (Review)

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[Intervention Review]

Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria

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ABSTRACT

Background

Malaria is a life-threatening parasitic disease and 40% of the world's population lives in areas affected by malaria. Insecticide-treated bednets (ITNs) effectively prevent malaria, however, barriers to their use have been identified.

Objectives

To assess the evidence on the effectiveness of available strategies that focus on delivery and appropriate use of ITNs.

Search methods

We searched the EPOC Register of Studies, CENTRAL, MEDLINE, EMBASE, HealthStar, CINAHL, PubMed, Science Citation Index, ProQuest Dissertations and Theses, African Index Medicus (AIM), World Health Organization Library and Information Networks for Knowledge (WHOLIS), LILACS, Virtual Health Library (VHL), and the World Health Organization Library Information System (WHOLIS). Initial searches were conducted in May 2011, updated in March 2012 and February 2013. Authors contacted organizations and individuals involved in ITN distribution programs or research to identify current initiatives, studies or unpublished data, and searched reference lists of relevant reviews and studies.

Selection criteria

Randomized controlled trials, non-randomized controlled trials, controlled before-after studies, and interrupted time series evaluating interventions focused on increasing ITN ownership and use were considered. The populations of interest were individuals in malaria-endemic areas.

Data collection and analysis

Two authors independently screened studies to be included. They extracted data from the selected studies and assessed the risk of bias. When consensus was not reached, any disagreements were discussed with a third author. The magnitude of effect and quality of evidence for each outcome was assessed.

Main results

Of the 3032 records identified, 10 studies were included in this review.

Effect of ITN cost on ownership:

Four studies including 4566 households and another study comprising 424 participants evaluated the effect of ITN price on ownership. These studies suggest that providing free ITNs probably increases ITN ownership when compared to subsidized ITNs or ITNs offered at full market price.

Effect of ITN Cost on appropriate use of ITNs:

Three studies including 9968 households and another study comprising 259 individuals found that there is probably little or no difference in the use of ITNs when they are provided free, compared to providing subsidized ITNs or ITNs offered at full market price.

Education:

Five studies, including 12,637 households, assessed educational interventions regarding ITN use and concluded that education may increase the number of adults and children using ITNs (sleeping under ITNs) compared to no education.

One study, including 519 households, assessed the effects of providing an incentive (an undisclosed prize) to promote ITN ownership and use, and found that incentives probably lead to little or no difference in ownership or use of ITNs, compared to not receiving an incentive.

None of the included studies reported on adverse effects.

Authors' conclusions

Five studies examined the effect of price on ITN ownership and found moderate-certainty evidence that ownership was highest among the groups who received the ITN free versus those who purchased the ITN at any cost. In economic terms, this means that demand for ITNs is elastic with regard to price. However, once the ITN is supplied, the price paid for the ITN probably has little to no effect on its use; the four studies addressing this outcome failed to confirm the hypothesis that people who purchase nets will use them more than those who receive them at no cost. Educational interventions for promoting ITN use have an additional positive effect. However, the impact of different types or intensities of education is unknown.

PLAIN LANGUAGE SUMMARY

Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria

Researchers in the Cochrane Collaboration conducted a review of the effect of different strategies to increase people's ownership and use of insecticide-treated bednets to prevent malaria. In February 2013 they identified 10 relevant studies. Their findings are summarized below.

What is malaria and how can insecticide-treated bednets prevent it?

Malaria is a life-threatening disease caused by a parasite. A person becomes infected from being bitten by a mosquito carrying the parasite. People with malaria may have symptoms such as chills, fever, vomiting, diarrhea, and jaundice. About 40% of the world's population is at risk of malaria, mostly in the poorest countries.

Insecticide-treated bednets fit over a bed and act as a barrier between insects and the person sleeping. The bednets are dipped in insecticide, a chemical that kills or repels mosquitoes and effectively prevent malaria. Insecticide-treated bednets cost money and it is important to find ways of ensuring that people who need them own them. Even when people own bednets they may not always use them properly. To be effective, bednets need to be used every night. They must also hang properly and be treated with enough insecticide. It is important to measure whether different strategies not only increase people's ownership but also people's use of bednets.

What this research says:

The studies included in this review took place in Africa and India. In five of the studies, people were either given insecticide-treated bednets free, or could buy them at a subsidized price or full market price. In the other five studies, people were educated about how to use the bednets properly, for instance through visits at home or through information on the radio, on television and in the community. The included studies show the following:

Providing free insecticide-treated bednets:

- Probably increases the number of people who own bednets compared to providing subsidized bednets or bednets offered at full market price.
- Probably leads to little or no difference in the use of bednets compared to providing subsidized bednets or bednets offered at full market price.

Providing education for the appropriate use of insecticide- treated bednets:

- May increase the number of adults and children under five using bednets (sleeping under bednets).

Providing incentives to encourage use of insecticide-treated bednets:

- Probably leads to little or no difference in ownership or use of bednets compared to those who did not receive an incentive.

A possible side effect when providing free or subsidized insecticide-treated bednets may be that the governments and institutions who pay for the bednets take this money from other priority issues. However, none of the included studies measured whether these or any other side effects had occurred.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Cost, education, and social marketing interventions to increase ITN ownership and use for malaria prevention

Cost, education, and social marketing interventions to increase ITN ownership and use for malaria prevention

Patient or population: Adults (including pregnant women) and children

Settings: Rural communities

Intervention: Free ITN (with or without social marketing), or education

Comparison: ITN at any cost (with or without social marketing), or no education

Outcomes	Impact	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
Distributing ITNs free compared to making ITNs available for purchase through different mechanisms				
ITN ownership among pregnant women, adults and children	Free ITN distribution probably increases the number of pregnant women, adults and children who own ITNs compared to providing subsidized ITNs or ITNs offered at full market price. ¹	5090 (5 studies) ²	⊕⊕⊕⊖ moderate certainty ³	Dupas 2009 noted that an increase in price from no cost to 1 USD led to a 35% drop in take-up; and a 25% drop as price increased from 1 USD to 2 USD. ⁴
Appropriate use	Free ITN distribution probably leads to little or no difference in rates of usage of ITNs compared to providing subsidized ITNs or ITNs offered at full market price.	8837 (4 studies) ⁵	⊕⊕⊕⊖ moderate certainty ⁶	
Education about appropriate ITN use compared with no ITN use education				
ITN use by adults (any ITN use)	May increase the number of adults using ITNs (including sleeping under ITNs).	889 (2 studies) ⁷	⊕⊕⊕⊖ moderate certainty ⁸	
ITN use by children under 5	May increase the number of children under 5 years old using ITNs (including sleeping under ITNs).	11,748 (3 studies) ⁹	⊕⊕⊕⊖ low certainty ¹⁰	
Providing incentives to encourage ITN use compared to no incentives				
Use (net mounted)	Providing incentives to encourage ITN use probably leads to little or no difference in ITN use compared to those who did not receive an incentive.	519 (1 study) ¹¹	⊕⊕⊕⊖ moderate certainty ¹²	
Adverse events	Not reported.			

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% CI) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: Confidence interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

Adverse events were not reported in the studies.

¹One study provided free ITNs to pregnant women, subsidized ITNs and social marketing to the community and compared this to control communities with access to subsidized ITNs and social marketing (Muller 2008). The second study provided women attending prenatal clinics with free ITNs, KES 10, KES 20, or KES 40 (Cohen 2010).

²The studies included in this outcome are Cohen 2010, Dupas 2009, Fink 2012, Muller 2008, and Tarozzi 2011. Cohen 2010 included 424 participants and the remainder of the studies reported the number of households (4666 households).

³Baseline imbalances for most variables in the Muller 2008 study and some outcomes mentioned in the protocol were not reported in the final study. The Cohen 2010 study has small sample sizes in each of the 4 groups. Unclear ROB. Baseline characteristics of study participants not described and some mismanagement (leakage) of ITNs. The Dupas 2009 study had small sample sizes in each price group and unclear ROB. The Tarozzi 2011 study had unclear method of randomization and the intervention and control clients may have different characteristics. Allocation concealment was not described in Fink 2012. Some baseline differences between groups (fewer sleeping spaces in the control group, fewer ITNs at baseline in the free group).

⁴Dupas 2009 randomly assigned households to a subsidy level for ITNs (40% to 100%). ITN cost ranged from free to KES 300 (USD 4.62). Households received a voucher to obtain their net at the randomly assigned price. They were also assigned a "marketing" group (health vs. financial framing vs. none), a "commitment" group, and a "targeting" group (female head of household, male head, or both) (Dupas 2009).

⁵The included studies are Cohen 2010, Dupas 2009, Fink 2012, and Tarozzi 2011. Cohen included 259 participants and the remaining studies included 9968 households.

⁶Downgraded because of inconsistency.

⁷Included studies are Amoran 2012 and Krezanoski 2010. The latter compared education with incentives vs no education or incentives. The number of participants reflects the number of households since these studies measured use at the household level.

⁸Baseline imbalances in the Amoran 2012 study (knowledge about appropriate ITN mounting was higher in the intervention group at baseline).

⁹Included studies are De La Cruz 2009, Deribew 2012, and Keating 2012. The number of participants reflects the number of households since these studies measured use at the household level.

¹⁰Baseline imbalances in all three studies in which ITN use was higher in the intervention groups. Inconsistency between studies (De La Cruz 2009; Deribew 2012; Keating 2012). Deribew 2012 is a CBA.

¹¹The included study is Krezanoski 2010.

¹²Single study with small sample size (Krezanoski 2010).

BACKGROUND

Malaria is a life-threatening parasitic disease transmitted by female *Anopheles* mosquitoes. Malaria has the highest impact on young children who have not yet developed acquired immunity. In pregnant women, malaria is associated with increased risk of severe anemia, low birth weight, as well as with an increase in miscarriages and maternal deaths (Desai 2007; WHO 2010b). According to the World Health Organization (WHO) World Malaria Report 2014, there were 198 million cases of malaria and 584,000 deaths in 2013, of which 78% were among children under five years old (WHO 2014). Approximately 40% of the world's population is at risk of malaria; those at risk are primarily in the world's poorest countries.

Malaria causes a significant economic burden at both the individual and the regional level; it has an enormous and long-lasting effect on economic growth and development. Malaria contributes to localized differences in gross domestic product (GDP) between countries with and without malaria, especially in Africa. The WHO states that in some countries personal and public spending on costs related to malaria accounts for up to "40% of public health expenditures, 30% to 50% of inpatient hospital admissions, [and] up to 60% of outpatient health clinic visits." The costs of malaria are borne disproportionately by those who can afford them the least: the poor and those who have limited access to health services (WHO 2010b).

The increase in international funding for fighting malaria has resulted in better access to malaria-preventive measures (WHO 2010c), including insecticide-treated bednets (ITNs) (Lengeler 2004); and indoor residual spraying and screens (Morel 2005; Pluess 2010). ITNs can reduce malaria mortality by 55% for children under 5 in sub-Saharan Africa (WHO 2014). However, the proportion of children under five years and pregnant women sleeping under ITNs is much lower than the coverage rates (Alaii 2003; Eisele 2009a). According to surveys conducted in Africa between 1999 and 2004, the median proportion of children under five sleeping under ITNs was only 3%. In countries with subsidized or free-of-charge ITN distribution, use has been scaled up successfully (WHO 2014). By 2013, ITN ownership increased in Africa: 49% of households owned at least one ITN and 44% of children slept under one (WHO 2014).

Increased funding contributed to the rapid rise in the number of ITNs procured and distributed within countries. For example, between 2004 and 2006 the Global Fund increased ITN funding from USD 1.35 million to USD 18 million and between 2004 and 2007 the United Nations Children's Fund (UNICEF) increased its procurement from 7 million ITNs to nearly 20 million (UNICEF 2007). The number of ITNs delivered by manufacturers in sub-Saharan Africa increased from 11 million in 2005 to 392 million in 2013. This suggests that ITN use was scaled up effectively in countries with subsidized or free ITNs (WHO 2014). Globally, 83 countries with ongoing malaria transmission provide free ITNs to all age groups (WHO 2014).

One of the barriers to the effective ownership and use of ITNs is the associated cost. For example, one Kenyan study found that although rural residents wanted to own and use ITNs, they could not afford them (Guyatt 2002). It was estimated that ITNs for an entire household would cost about the same as paying for three children to attend one year of primary school (Guyatt 2002). Another barrier to ITN use is that people are often unfamiliar

with ITNs, or do not have a habit of using them, so they need to be convinced of their usefulness and persuaded to use them on a regular basis (WHO 2010a). The culture of ITN use is more developed among some ethnic groups and this has a significant impact on ITN coverage. Wealth, living in an urban rather than rural area and higher levels of education are other important factors positively associated with ITN ownership and use, and their impacts on coverage need to be assessed (Belay 2008; Eisele 2009b; Monasch 2004).

Description of the intervention

WHO defines an insecticide-treated bednet (ITN) as a "mosquito net that repels, disables and/or kills mosquitoes coming into contact with insecticide on the netting material" (WHO 2007). Appropriate use of ITNs requires that they are hanging correctly and that they are used consistently (Eisele 2009b).

Strategies to increase ownership and use of ITNs include social marketing, health education campaigns by multidisciplinary teams, developing a 'net culture' through promotion and publicity, increased availability (e.g. local production of high-quality ITNs), free ITN distribution campaigns and cost reduction (e.g. reduced taxes imposed on ITNs) (WHO 2010a).

In the preceding decade, there has been much controversy over how ITNs should be distributed. This controversy can be roughly summarized as social marketing of subsidized ITNs versus free distribution of ITNs (Curtis 2003; Lines 2003). Social marketing of ITNs applies methods of commercial marketing, such as advertising, and includes the provision of ITNs through voucher schemes or direct sales in which the purchaser pays a portion of the product's cost, with public sources financing the difference (Armstrong Schellenberg 1999). Free distribution entails the provision of free ITNs at selected points of care, such as antenatal clinics, and mass campaigns of regional or national provision, usually in tandem with other health interventions (Lengeler 2007). Many, probably most, of these ITNs were freely distributed and many were piggybacked on other public health campaigns, such as immunization campaigns (Grabowsky 2005; Grabowsky 2007).

Why it is important to do this review

While mass distribution of ITNs is necessary, it is not sufficient to ensure mass use of ITNs. Therefore, it is important to identify strategies that will both increase the ownership of ITNs and encourage appropriate use. This review assesses current evidence on strategies to increase ownership and use of ITNs and addresses a global health issue that is a core part of the United Nations' Millennium Development Goal (MDG) number six, which aims to 'Combat HIV/AIDS, Malaria and other diseases' (UN 2008). This review can help policy-makers and practitioners make appropriate and evidence-based decisions regarding ITN programs to help roll back malaria by identifying effective strategies to increase the ownership and appropriate use of ITNs, and the contexts and populations in which these strategies are effective.

OBJECTIVES

To assess the evidence on the effectiveness of available strategies that focus on delivery and appropriate use of ITNs.

METHODS

Criteria for considering studies for this review

Types of studies

In this review, we included studies that reported on strategies that may increase ownership and the appropriate use of ITNs. Evaluating these interventions using randomized controlled trials (RCTs) may be challenging since scale-up strategies are delivered at a population level and are the standard of care in at-risk populations (WHO 2010c). Further, achieving unbiased randomization is difficult for a vector-borne disease where geographic displacement of short distances between comparators (under a kilometre) may result in differences affecting the vector's ecology and disease transmission. Thus, we also considered non-randomized trials in our review.

We considered any study design meeting the study design criteria from the Cochrane Effective Practice and Organisation of Care Group (EPoC 2014a). Studies considered were: RCTs; cluster RCTs; non-randomized controlled trials; controlled before-after studies (CBAs) with contemporaneous data collection and with two or more control and intervention sites; and interrupted time series studies (ITSS) with a clearly defined point in time when the intervention occurred and at least three data points before and after implementation of the intervention.

Types of participants

We included children and adults with permanent residence in malarious areas. Participants could include individuals or groups of individuals (e.g. families, households). We excluded military populations, travelers, students, those living in transient refugee camps for less than one malaria season, and others not permanently residing in the study area. These groups were excluded because their characteristics differ from the characteristics of populations that permanently reside in these areas since they may have greater access to ITNs and other malaria-preventive measures. For example, in addition to ITNs, military populations may have access to mosquito repellents and antimalarial drugs that are not available to ordinary residents (Ockenhouse 2005).

Types of interventions

Our systematic review included both unifaceted and multifaceted interventions that aimed to increase the ownership and appropriate use of ITNs. Unifaceted interventions are interventions with only one component (e.g. ITN distribution only), whereas multifaceted interventions consist of two or more components (e.g. free ITNs bundled with education about appropriate ITN use). To clarify the relationship between the interventions and the outcomes (Tugwell 2010), we developed a logic model (Figure 1). Interventions are grouped into three main categories depending on their focus: increasing ITN ownership (through delivery strategies), appropriate use of ITNs, and combinations of these.

Figure 1. LOGIC MODEL: Strategies to increase the use of insecticide-treated nets in households and vulnerable populations to reduce morbidity and mortality from malaria in endemic settings

ITN Ownership

The framework by Kilian 2010 was adapted and incorporated into our logic model (Figure 1 and Figure 2). Kilian's framework is a descriptive categorization of the various components of ITN

delivery strategies intended to increase ITN ownership. Categories that are defined by this framework include ITN delivery channel, duration of distribution, cost to user, choice of ITN in terms of net preference and accessibility, and sectors involved in the distribution (Kilian 2010).

Figure 2. Framework of components of interventions to increase the ownership and use of ITNs

*Adapted from Kilian et al. Review of delivery strategies for insecticide treated mosquito nets – are we ready for the next phase of malaria control efforts? 2009

Appropriate ITN Use

Interventions focusing on appropriate ITN-use strategies were categorized using a logic model that builds on Kilian's framework (Figure 1 and Figure 2) (Kilian 2012). Examples of interventions to increase use are campaigns to increase ITN hang-up and volunteer home visits to educate populations about the appropriate use of ITNs. Interventions to encourage appropriate use can be delivered through different channels (community, outreach, routine services and at retail points). These interventions can be provided during limited periods of time (single or repeated) or they can be ongoing (continuous). Appropriate-use interventions can be delivered by the public sector (e.g. government) or private sector (civil society; non-governmental organizations (NGOs); faith- and community-based organizations; and the commercial sector). Interventions are further categorized as those focusing on education, peer monitoring (e.g. volunteer home visits), or publicity (e.g. media). We reported relevant context information that may affect the appropriate use of ITNs (e.g. national/regional culture, ITN stock-out periods, nomadic lifestyle).

Comparison groups included no intervention and other strategies aiming to increase ITN use (e.g. comparing two different interventions that are aiming to increase ITN use). We excluded studies focusing solely on the effectiveness of ITNs. Excluded studies informed the background and discussion sections of the review.

Types of outcome measures

Primary outcomes

ITN Ownership

- Proportion of households with at least one ITN.
- Proportion of households with people/ITN ratio ≤ 2.0 among households with any bednets.

Appropriate ITN Use

- Proportion of existing ITNs used.
- Proportion of population sleeping under ITNs.

- Proportion of pregnant women sleeping under ITNs.
- Proportion of children under five years sleeping under ITNs.
- Proportion of households with all children under five years sleeping under ITNs.

We included measures of ITN use during the previous night and measures of ITN use for which the timeframe of use was not reported.

Secondary outcomes

- Equity ratio of household ownership with ITNs calculated across household income.
- Child all-cause mortality.
- Child malaria-specific mortality.
- Child malaria morbidity.
- All-cause mortality.
- Malaria-specific mortality.
- Malaria-specific morbidity.
- Anemia in pregnant women.

- Low birth weight.

We included these secondary outcomes since ownership and appropriate use of ITNs will result in measurable differences in these clinical outcomes, as demonstrated in a previous systematic review ([Lengeler 2004](#)). Our outcome measures are congruent with the Roll Back Malaria Monitoring & Evaluation Reference Group (MERG) minimum standards recommended for assessing malaria impact in countries in sub-Saharan Africa ([Kilian 2011](#); [Roll Back Malaria Partnership 2008](#)).

We planned to record any adverse or any unintended effects reported (e.g. unable to afford other necessities due to money used by households to purchase ITNs).

Search methods for identification of studies

The initial search was conducted in May 2011. Updates of the initial search were conducted in March 2012 and February 2013. Search results are reported in a PRISMA flow diagram ([Figure 3](#)) ([Moher 2009](#)).

Figure 3. Study flow diagram.

Figure 3. (Continued)

The EPOC Trials Search Coordinator developed search strategies (Appendix 1) in consultation with the authors. They comprise keywords and controlled vocabulary terms for malaria or parasites causing malaria in humans (*Plasmodium falciparum/malariae/ovale/vivax* and insecticide-treated bednets or mosquito nets). Language limits were not applied. Databases were typically searched from database start date forward; dates of database coverage are provided in the list of databases below. Two methodological search filters were used to limit retrieval to appropriate study design and interventions of interest: the Cochrane RCT Sensitivity/Precision Maximizing Filter (cf. the *Cochrane Handbook for Systematic Reviews of Interventions* 6.4d); and an EPOC Filter to identify study designs including CBA, ITS, and other quasi-experimental designs acceptable in EPOC reviews.

Databases

- The Cochrane Central Register of Controlled Trials (CENTRAL), part of *The Cochrane Library*. www.thecochranelibrary.com [2013, Issue 1]
- MEDLINE, OVID [1948 to February 2013]
- EMBASE, OVID [1947 to February 2013]
- HealthStar, OVID [1999 to February 2013]
- Cumulative Index to Nursing and Allied Health Literature CINAHL, EbscoHost [1980 to February 2013]
- The EPOC Specialised Register, Reference Manager [2013, Issue 1]
- PubMed [up to February 2013]
- Science Citation Index, Social Sciences Citation Index [1975 to February 2013 (Web of Science)]
- Dissertations and Theses, ProQuest [1861 to February 2013]
- African Index Medicus (AIM), World Health Organization (WHO) [up to February 2013]
- Latin American and Caribbean Health Sciences database (LILACS), Virtual Health Library (VHL) [up to February 2013]
- World Health Organization Library Information System (WHOLIS) [WHO publications, 1948 to February 2013; WHO journals & technical documents, 1986 to February 2013]

Searching other resources

Other systematic reviews

Related systematic reviews were identified by searching the Database of Abstracts of Reviews of Effectiveness (DARE) and the databases listed above.

Gray literature

An extensive gray literature search was conducted. Gray literature sites were identified using a list of databases relevant to low- and middle-income countries and websites compiled by the EPOC Group's Norwegian satellite office (<http://epocoslo.cochrane.org/lmic-databases>) and *Grey matters: a practical search tool for evidence-based medicine* (<http://cadth.ca/resources/grey-matters>). Search strategies for these databases and web sites were simpler than those used in mainstream databases such as MEDLINE and EMBASE. Gray literature sites, search terms, and number of results are provided in Appendix 2.

Additionally, we:

- Reviewed reference lists of relevant systematic reviews and studies selected for inclusion in this review.
- Contacted authors of relevant studies or reviews to clarify reported published information or to seek unpublished results/data.
- Contacted agencies that either conduct studies or provide funding for malaria interventions and requested data from unpublished and ongoing studies. These agencies included UNICEF, United Nations Foundation, International Federation of Red Cross and Red Crescent Societies, World Health Organization, United States Agency for International Development (USAID), the Johns Hopkins Bloomberg School of Public Health, Population Services International (PSI), World Bank, World Vision, and Alliance for Malaria Prevention.
- Conducted reference searches on studies selected for inclusion in this review, studies cited in related reviews, and other relevant citations in ISI Web of Science/Web of Knowledge.

Data collection and analysis

The data collection and analysis were conducted following the guidelines available in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

Selection of studies

Two individuals independently screened all titles and abstracts for potentially relevant studies. Full-text copies of all papers that were deemed potentially eligible by consensus of two authors were retrieved and screened against the inclusion criteria. Any disagreement about the eligibility was resolved by discussion

between the two review authors and by consulting a third review author as necessary.

Data extraction and management

Two review authors independently undertook data extraction from the full text of each eligible study based on the EPOC Data Collection Checklist (EPOC 2010). Any disagreement was resolved by discussion between the two review authors and consultation with a third author if required. If any data were missing, we contacted the relevant corresponding authors. We collected data for specific populations (e.g. pregnant women, low socioeconomic status) for use in subgroup analyses, as described below.

Assessment of risk of bias in included studies

Two review authors independently assessed risk of bias for included studies. For RCTs, we assessed the risk of bias using the Cochrane Collaboration's 'Risk of bias' tool (Higgins 2011), which assesses the following domains: generation of randomization sequence, allocation concealment, blinding of participants and providers, blinding of outcome assessors, selective outcome reporting, incomplete outcome data, and other sources of bias (e.g. major baseline differences, etc.). We assessed each potential source of bias and graded as high, low or unclear. A justification for our judgment is reported in the 'Risk of bias' tables. Any disagreement about the risk of bias was resolved by discussion between two authors, and with a third review author when necessary. Due to the characteristics of interventions that we explored in our review, blinding of study participants and providers was not possible. However, lack of blinding was still considered a high risk of bias.

For other study designs, we used the risk of bias criteria suggested by EPOC:

- generation of allocation sequence;
- concealment of allocation;
- baseline outcome measurements;
- baseline characteristics;
- incomplete outcome data;
- blinding of outcome assessor;
- protection against contamination;
- independence of intervention from other changes (ITS only);
- pre-specified shape of the intervention (ITS only);
- intervention unlikely to affect data collection (ITS only);
- selective outcome reporting; and
- other risks of bias (EPOC 2014b).

Measures of treatment effect

We reported pre-intervention and post-intervention means or proportions for both study and control groups. For any baseline imbalances, we calculated unadjusted and adjusted absolute change from baseline with 95% confidence intervals (CIs), where baseline results were available from RCTs, non-randomized controlled trials, and CBAs. We accounted for existing ITNs when reported by authors.

Additionally, we reported findings separately for RCTs, non-randomized controlled trials, and CBAs.

Unit of analysis issues

Where possible, we attempted to re-analyse data with potential unit of analysis errors. In cluster-randomized trials, a cluster is the unit of allocation. The cluster refers to a group of individuals enrolled in the study such as medical clinic patients, villages or families. The individuals within a cluster may be more similar in their characteristics than they are to individuals in other clusters. Therefore, it would be incorrect to analyse the data as if the individual participants were the unit of allocation. For cluster-randomized trials with unit-of-analysis errors, we used statistical methods to perform the analysis at the individual level while accounting for inter-cluster correlation. We used the *Cochrane Handbook for Systematic Reviews of Interventions*' methods to calculate the variance inflation factor (Higgins 2011). Eight of the ten included studies were cluster RCTs (cRCT). Muller 2008 required re-analysis because the sampling unit within the clusters was households and data in the paper were presented for individuals. Muller 2008 reported using a design effect of two to account for potential intra-cluster correlation (ICC). To calculate CIs, we adjusted the observed proportions using the design effect of two as reported in the study (Muller 2008). The other cRCTs were deemed to be appropriately analysed as they considered the unit of randomization to be at the cluster level (Amaran 2012; Cohen 2010; Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Tarozzi 2011).

Dealing with missing data

We attempted to obtain missing data from the authors of the included studies. When this was not possible, we performed the analysis using only the available data. We explored the impact of missing data on the review findings in the Discussion section of our review.

Assessment of heterogeneity

We described the variability of interventions identified in our review using a logic model and framework (Figure 1 and Figure 2). We planned to explore heterogeneity using forest plots and the I^2 statistic, if possible. We planned to perform χ^2 tests and evaluate P values using 0.10 as a cut-off point. The importance of I^2 would depend on the strength of evidence of heterogeneity (P value from χ^2 test or a CI for I^2) and on the magnitude and direction of effects.

Assessment of reporting biases

We planned to use funnel plots to explore the possibility of publication bias, if 10 or more studies were included in any meta-analysis and if studies were of different sizes. We would have visually inspected funnel plots for asymmetry and explored reasons for asymmetry. However, we did not include 10 or more studies in the meta-analysis.

Data synthesis

We performed data synthesis using Review Manager 5.1 (RevMan) (RevMan 5.1). We reported the overall number of studies included in the review and the main research questions addressed. We synthesized information about study methods (e.g. study design, duration of intervention, follow-up); participants (e.g. sex/gender, age, country, setting); intervention (e.g. intervention description and its components, means of delivery, methods of communication); setting (for both control and intervention group if available); outcomes (list of outcomes and time points

reported); and notes (other details of the study that do not fall under mentioned categories). We commented on study designs, analytical methods, risk of bias, generalizability and relevance of study results as well as other important study characteristics.

We reported the outcomes of interest as published in the original papers. Due to lack of standardization of outcomes, we were only able to pool the results from two studies for the outcome "nets owned per capita (measured as nets owned)" (Fink 2012; Tarozzi 2011). We used a random-effects model for this analysis and a generic inverse-variance model of analysis. When other outcomes were similar, we reported the direction of the effect (e.g. we considered "households with at least one ITN" and "households with appropriately hanging ITNs" as similar outcomes). Some outcome measurements are considered more reliable than others (e.g. inspection of ITNs in the house versus self-reporting of the use of the ITN), so we also reported the outcomes grouped by the way in which the outcome was assessed, if appropriate.

We included the magnitude of the effects of the interventions and the quality of evidence, by summarizing available data on each of the outcomes of interest. We included both relative and absolute measures of effect when possible.

We reported effect sizes for each included study using risk ratios (RRs) and odds ratios (ORs) (random-effects models) with 95% CIs. Where possible, we have used RRs. For four studies, we have reported ORs for some outcomes, as reported by the study authors. These results were analyzed using logistic regression as the baseline data required to convert these to RRs were not available. Where studies reported more than one measure for each endpoint, we abstracted the primary measure (as defined by the authors of the study).

We compared included studies with an emphasis on explanation for potential differences between study results, taking into account the context where the intervention was implemented. We included a table that summarizes characteristics and findings of included studies in a consistent and systematic manner (Table 1), following our logic model and framework (Figure 1 and Figure 2).

We assessed the certainty of evidence for each primary outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach and the GRADEpro software (Guyatt 2008a). The certainty of the evidence may be downgraded for factors such as study limitations, inconsistency of results, imprecision, indirectness of evidence, or publication bias. Factors that increase the certainty of the evidence include a large magnitude of effect, plausible confounding, and dose-response gradient (Guyatt 2008b). Finally, we presented the main findings in 'Summary of findings' tables.

Subgroup analysis and investigation of heterogeneity

We planned to conduct subgroup analyses to explore heterogeneity, according to the following study characteristics: the type of intervention as per the logic model (Figure 1 and Figure 2) (e.g. cost to end user); specific population characteristics (e.g. gender/sex, ethnicity, geographic areas, rural/urban, socioeconomic status, education, age/subgroup (children under five years and pregnant women)); and the number and type of interventions in each strategy. However, we had insufficient data to complete these planned subgroup analyses.

We also extracted details on the above subgroup analyses conducted within the included studies.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

Results of the search

Our search strategy yielded 3032 references. During the abstract screening process, we excluded 2899 references for failing to meet one or more inclusion criteria. The remaining 133 references were reviewed as full-text, plus an additional three studies identified through reference-list checking and two identified through personal communication with experts. We excluded 117 studies that did not meet our eligibility criteria and excluded eight others after obtaining information from the study authors. Thirteen studies met our eligibility criteria and ten were included in our review. Of the remaining three studies, two are ongoing and one requires additional information from the authors. For details please see Figure 3 and the [Characteristics of excluded studies](#) table. Full results from the gray literature searches are available on request.

Included studies

Ten studies were included in this review: eight cluster RCTs (Amaran 2012; Cohen 2010; Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008, Tarozzi 2011); one RCT (De La Cruz 2009); and one CBA study (Deribew 2012). Nine of the included studies included 17,203 households (Amaran 2012; De La Cruz 2009; Deribew 2012; Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008; Tarozzi 2011). The remaining study reported by individual and included 424 participants (Cohen 2010).

Additionally, three other studies were eligible but not included: one study is awaiting classification (Soleimani Ahmadi 2012); and the two remaining studies are ongoing (Kilian 2012; Siekmans 2012).

Study participants

Study participants in our review were recruited in rural Africa (Amaran 2012; Cohen 2010; De La Cruz 2009; Deribew 2012, Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008); and rural India (Tarozzi 2011). They belong to several categories: adults who were enrolled during household visits (Krezanoski 2010; Dupas 2009); pregnant women enrolled through prenatal clinics (Cohen 2010; Muller 2008); mothers of children under five years old (Amaran 2012); adults and women of reproductive age enrolled using client lists of NGOs that offer financial services in the community (De La Cruz 2009; Tarozzi 2011); rural cotton farmers (Fink 2012); heads of households, pregnant women, and children under five (Deribew 2012), and all households in selected villages (Keating 2012).

Characteristics of intervention

Interventions in studies included in our review aimed to increase the ownership or use of ITNs. We categorized them according to the logic model developed for this review in which interventions are divided into those focusing on different ITN delivery strategies (to increase ITN ownership) and those interventions focusing on appropriate use (Figure 1 and framework in Figure 2). A detailed

classification of interventions used in each included study can be found in [Table 1](#) in which the included studies are mapped according to the logic model.

Five included studies used a combination of strategies focusing on ITN delivery to increase ITN ownership and appropriate use (Cohen 2010; Dupas 2009; Krezanoski 2010; Muller 2008; Tarozzi 2011). One study focused on delivery strategies to increase ownership only (Fink 2012) and four studies examined appropriate use strategies (Amaran 2012; De La Cruz 2009; Deribew 2012; Keating 2012).

Delivery strategies to increase ITN ownership included administering the intervention through routine services (e.g. prenatal clinics) (Cohen 2010; Muller 2008); or administering the intervention in the community (e.g. house-to-house visits) (Dupas 2009; Fink 2012; Krezanoski 2010; Tarozzi 2011).

Interventions to promote the appropriate use of ITNs were provided mainly through the community (Amaran 2012; Dupas 2009; De La Cruz 2009; Deribew 2012; Keating 2012; Muller 2008; Tarozzi 2011). Different educational methods were used to increase the use of ITNs. These included: training for household heads (Deribew 2012); house-to-house visits to teach the population how to appropriately hang and use an ITN, educational sessions plus printed materials (Amaran 2012; Keating 2012); and train-the-trainer education sessions (De La Cruz 2009). Appropriate ITN-use interventions were available as one-time activities (e.g. during house-to-house visits (Dupas 2009); or during the whole duration of the campaign (e.g. Muller 2008 used long-term ITN social marketing); and were coordinated by civil society or the public sector, mainly by NGOs with local community services involved (Deribew 2012; Dupas 2009; Muller 2008; Keating 2012). Some studies identified pregnant women and children under the age of five as populations of special interest (Amaran 2012; Cohen 2010; De La Cruz 2009; Deribew 2012; Keating 2012; Tarozzi 2011).

The interventions in all studies were part of campaign evaluation and were of a relatively brief duration. Furthermore, study participants could choose the type of ITN in only one study - in this study participants could choose the size of the ITN they purchased (Tarozzi 2011). When evaluating the cost to end users, ITNs were provided to study participants free (Amaran 2012; Cohen 2010; Deribew 2012; Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008); partially subsidized (Cohen 2010; Dupas 2009; Muller 2008; Fink 2012); and at a full market price (Fink 2012; Tarozzi 2011). The public sector (e.g. prenatal clinics) (Cohen 2010; Fink 2012; Keating 2012; Muller 2008), the commercial sector (e.g. local retailers) (Dupas 2009; Muller 2008), and civil society (e.g. NGOs) (Deribew 2012; Dupas 2009; Krezanoski 2010; Tarozzi 2011) were involved in the distribution of ITNs.

Outcomes measured

The outcomes reported in the identified studies were ITN ownership, ITN use, and malaria morbidity. Outcomes measured in pregnant women or children under the age of five were reported separately as these populations are identified as vulnerable groups.

Excluded studies

Eighteen articles were identified as potentially eligible during the full text screening, of which eight articles referring to seven studies were excluded from the review ([Characteristics of excluded studies](#)). Studies were excluded for the following reasons: not an eligible study design, or they assessed the efficacy of ITNs rather than a strategy to increase ownership, use, or both.

Risk of bias in included studies

The risk of bias for each included study is described in the [Characteristics of included studies](#) and shown in [Figure 4](#) and [Figure 5](#).

Figure 4. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 5. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Baseline outcome measurements	Adequate protection from contamination	Other bias
Amoran 2012	+	+	-	?	-	-	-		-
Cohen 2010	+	+	?	?	-	-	?		?
De La Cruz 2009	?	?	?	?	-	-	-		?
Deribew 2012	-	-	-	+	-	-	-	+	+
Dupas 2009	+	+	?	?	-	-	?		+
Fink 2012	+	+	?	?	-	-	?		+
Keating 2012	?	+	?	?	?	?	-		-
Krezanoski 2010	+	+	+	?	-	-	+		+
Muller 2008	?	+	?	-	-	-	-		+
Tarozzi 2011	?	+	?	?	-	-	+		?

Figure 5. (Continued)

Allocation

Selection bias was assessed as low in most studies (Cohen 2010; Dupas 2009; Fink 2012; Krezanoski 2010; Tarozzi 2011). The method of randomization was unclear for four studies (Amaran 2012; De La Cruz 2009; Keating 2012; Muller 2008). One study was a non-randomized study and assessed as high risk for selection bias (Deribew 2012).

Blinding

Assessment of outcomes was both objective (e.g. visual observation of ITN being used, blood tests for malaria parasite and hemoglobin levels) (Cohen 2010; Deribew 2012; Fink 2012; Krezanoski 2010; Muller 2008); and subjective (e.g. self-reported ITN use) (Amaran 2012; Cohen 2010; Dupas 2009; De La Cruz 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008; Tarozzi 2011). Cohen 2010 used blinding for both study participants and the individuals involved in the intervention administration by not disclosing that ITN use would be evaluated. However, due to the nature of the interventions (e.g. distributing free ITNs), blinding of study participants or assessors was not always possible. In Deribew 2012, the same individuals who administered the intervention also collected outcome data.

Incomplete outcome data

The risk of bias for incomplete outcome data reporting was assessed as unclear in nine of the studies, because data on attrition and loss to follow-up were not fully reported (Amaran 2012; Cohen 2010; Dupas 2009; De La Cruz 2009; Fink 2012; Keating 2012; Krezanoski 2010; Muller 2008; Tarozzi 2011). The Deribew 2012 study had a high number of dropouts which was not explained by the authors and therefore was assessed as being at high risk of bias.

Selective reporting

Muller 2008 was the only study that provided a study protocol. This study did not report all the outcomes described in the protocol (e.g. costs per malaria case, insecticide content on ITN, acceptance of health staff and population) and thus the risk of bias for selective reporting was assessed as high. Deribew 2012 described the study methods and baseline results in a separate publication and all outcomes assessed at baseline were assessed post-intervention. Therefore, this study was assessed as low risk of bias. The risk of bias for selective reporting was assessed as unclear for the remaining studies (Amaran 2012; Cohen 2010; De La Cruz 2009; Dupas 2009; Fink 2012; Keating 2012; Krezanoski 2010; Tarozzi 2011).

Other potential sources of bias

One study was reported to be at high risk of other sources of bias as it did not include any objective measures of ITN use following the educational intervention and relied on self-reported ITN use (Amaran 2012).

Five of the studies were evaluated to have unclear risk for other potential sources of bias for reasons described below (Cohen 2010; De La Cruz 2009; Dupas 2009; Keating 2012; Muller 2008).

Cohen 2010 observed some leakages and mismanagement of ITNs in 4 of 11 clinics asked to sell ITNs at a positive price. In De La Cruz 2009 there was a difference in the characteristics of study participants at baseline between the intervention and the control groups.

Keating 2012 found that some lay or community health workers (CHW) delivered the intervention to control group communities and the results indicate that some control houses received information about malaria or assistance with hanging a net. Additionally, the intervention group had higher ITN use at baseline. The authors also reported contamination across communities, with 47% of children in the intervention communities living in houses reporting exposure to the CHW intervention and 31% of children in control houses reporting the same exposure (Keating 2012).

Two studies observed some differences in participants' characteristics at baseline (Deribew 2012, Muller 2008). Dupas 2009 did not report on similarity in baseline characteristics between the intervention and the control groups enrolled in their study so the risk of other potential sources of bias was unclear.

Other potential sources of bias were not observed or suspected in the other three included studies (Fink 2012; Krezanoski 2010; Tarozzi 2011).

Effects of interventions

See: [Summary of findings for the main comparison Cost, education, and social marketing interventions to increase ITN ownership and use for malaria prevention](#)

See: [Summary of findings for the main comparison](#)

The results are reported by intervention, as described in the logic model.

Impacts of distributing free ITNs compared to making ITNs available for purchase through different mechanisms

The five studies that broadly addressed this comparison indicate overall that providing free ITNs probably increases the number of people who own ITNs compared to providing subsidized ITNs or ITNs offered at the full market price (moderate-certainty evidence) (Dupas 2009; Cohen 2010; Muller 2008; Fink 2012; Tarozzi 2011). The studies also indicate that providing free ITNs probably leads to little or no difference in usage of ITNs, compared to providing subsidized ITNs or ITNs offered at the full market price (moderate-certainty evidence).

The following section reports the results of the specific comparisons separately. Where an outcome is not listed, it was not assessed by the studies in that comparison.

Comparison 1: Free ITN compared to paying for an ITN (range of costs)

Three studies addressed this comparison (Dupas 2009; Cohen 2010; Muller 2008). Overall, these studies found that providing free ITNs probably increases ITN ownership compared to providing subsidized ITNs or ITNs at market price (moderate-certainty evidence) (Summary of findings for the main comparison).

The first study was conducted in rural Kenyan villages and evaluated four different interventions and their impact on ITN ownership and use among children and adults (Dupas 2009). In this study, households were randomly assigned to: a subsidy level (from 40% to 100% subsidy); one of three "marketing" groups (health framing, financial framing or no marketing); one of two "commitment" groups (verbal commitment or no verbal commitment); and one of three "targeting" groups (male head, female head, or both female and male head of household) (Dupas 2009). The effect of the "marketing", "commitment", and "targeting" interventions on use are presented later.

The second study included pregnant women from rural Kenya and compared the impact of different levels of subsidy for ITNs on ITN ownership and use (Cohen 2010). ITNs in this study were provided either free; or for KES 10 (approximately \$0.15 USD; 97.5% subsidy); or KES 20 (approximately \$0.30 USD; 95% subsidy); or KES 40 (approximately \$0.60 USD; 90% subsidy).

Muller 2008 was conducted in rural Burkina Faso and evaluated the effect of social marketing with and without free distribution of ITNs to pregnant women through prenatal clinics. Highly subsidized ITNs were available for the whole study area.

Ownership

Three studies assessed this outcome (Cohen 2010; Dupas 2009; Muller 2008).

The Dupas 2009 study found that receiving a free ITN probably increases ITN ownership. ITN ownership was the highest among the free group compared to those who paid any price (RR 3.02, 95% CI 2.78 to 3.30, moderate certainty evidence) (Analysis 6.1). Dupas 2009 observed that an increase in price from no cost to USD 1 reduces ITN ownership among households by 35% and an increase in price from USD 1 to USD 2 reduces ITN take-up by an additional 25% (Dupas 2009) (Analysis 1.1; Analysis 2.1; Analysis 3.1; Analysis 4.1; Analysis 5.1).

Cohen 2010 found that providing free ITNs probably increases ITN ownership compared to those providing ITNs at any price point (RR 1.29, 95% CI 1.25 to 1.33, moderate-certainty evidence) (Analysis 10.1).

Free distribution of ITNs to pregnant women plus social marketing probably increases ITN ownership compared to social marketing alone (RR 1.49, 95% CI 1.14 to 1.95, moderate-certainty evidence) (Analysis 11.1) (Muller 2008).

Appropriate use

Overall, the two studies that assessed this outcome found that free ITN distribution probably leads to little or no difference in appropriate ITN use, compared to providing subsidized ITNs or ITNs offered at the full market price (moderate-certainty evidence).

Dupas 2009 reported that there is probably little to no difference in ITN usage between those who received the ITN at no cost and those who paid for it (moderate-certainty evidence) (Analysis 1.2; Analysis 2.2; Analysis 3.2; Analysis 4.2; Analysis 5.2).

Cohen 2010 also found that there is probably no pattern of increasing use with increasing ITN price. Specifically, the study noted that there was probably little to no difference in ITN usage between those who received the ITN free and those who paid KES 10, 20, or 40 (moderate-certainty evidence) (Analysis 7.2; Analysis 7.3; Analysis 8.2; Analysis 8.3; Analysis 9.2; Analysis 9.3).

Secondary outcomes

Equity ratio of household ownership

The included studies did not contain enough information to calculate the equity ratio of household ownership of ITNs according to household income. Dupas 2009 reported observational data that baseline wealth and financial access predicted ITN ownership but, once purchased, they did not predict ITN use. In the same study, baseline educational levels of household members (male or female) did not predict ITN ownership (Dupas 2009). Cohen 2010 reported that women who paid KES 40 for their ITN were slightly more likely to pay for transportation to the clinic, to be literate and to be wearing shoes when attending the clinic.

Comparison 2: Free ITN compared to ITN available for purchase using a microfinance loan

Two studies assessed this comparison (Fink 2012; Tarozzi 2011).

Fink 2012 had three arms: a control group who did not receive the intervention; a group that received free ITNs (up to one ITN for each uncovered sleeping space); and a loan group who could obtain one ITN per sleeping space at 50% subsidized cost. The loan group was required to repay the loan by the end of the harvest period.

Tarozzi 2011 conducted a large-scale study in rural India. The study had three arms: a control group that did not receive the intervention (ITNs were available at market price); a group that received free ITNs based on household composition (free group); and a group that was offered microfinance loans (due to be repaid in one year) (MF group). These loans could be used to purchase ITNs or re-treatments. Outcomes related to ITN ownership, ITN use, anemia and malaria infection status were reported. ITN use was measured both with self report and with direct observation (Tarozzi 2011).

Ownership

The pooled data for Fink 2012 and Tarozzi 2011 suggest that receiving an ITN at no cost probably increases ITN ownership, compared to purchasing an ITN at the market price (SMD 0.69, 95% CI 0.39 to 0.99, moderate-certainty evidence) (Analysis 12.1) or purchasing an ITN using a loan (SMD 0.37, 95% CI 0.27 to 0.47, moderate-certainty evidence) (Analysis 14.1). There is probably little to no difference in ITN ownership when comparing groups in which ITNs were purchased using a loan and those in which ITNs were purchased at the market price (SMD 0.29, 95% CI -0.06 to 0.63, moderate-certainty evidence) (Analysis 13.1).

Appropriate use

Fink 2012 found that there was probably little to no difference in ITN use between those who received a free ITN and those who bought ITNs using a loan or at the market price. Approximately 90%

of households in all three arms were using ITNs when assessed at follow-up. The mean difference in ITN use (measured as ITNs seen hanging at follow-up) was:

- 1.42 higher in the free group compared to control;
- 0.79 higher for the microfinance group compared to control; and
- 0.63 higher for the free group compared to the microfinance group (moderate-certainty evidence).

Tarozzi 2011 noted that self-reported ITN use was probably lower in the microfinance group than in the free group for the previous night (OR 0.74, 95% CI 0.68 to 0.79, moderate-certainty evidence) (Analysis 14.4) and during the peak season (OR 0.66, 95% CI 0.61 to 0.72, moderate-certainty evidence) (Analysis 14.3). Field staff were able to verify the usage of ITNs in 93% of free households and 89% of microfinance households.

Secondary outcomes

Malaria-specific morbidity in children

Fink 2012 found that children under 15 years in the groups receiving free ITNs or through loans were probably less likely to report confirmed malaria than controls (Free group versus control: OR 0.547, 95% CI 0.231 to 0.993; Loan group versus control: OR 0.444, 95% CI 0.213 to 0.924, moderate-certainty evidence) (Fink 2012). Among children under 5 years old in the Tarozzi 2011 study, malaria prevalence was 11% in the control group but 18.4% in the free group and 19.8% in the microfinance group.

Malaria-specific morbidity in adults

Fink 2012 noted that the number of confirmed cases of malaria in adults over 15 years was probably fewer in the free and loan groups compared to controls (Free group versus control: OR 0.361, 95% CI 0.122 to 1.072, moderate certainty evidence; Loan group versus control: OR 0.307, 95% CI 0.106 to 0.887, moderate-certainty evidence) (Fink 2012).

Impacts of interventions to promote the appropriate use of ITNs

Five studies assessed the impacts of educational interventions on the appropriate use of ITNs (De La Cruz 2009, Deribew 2012, Keating 2012, Amoran 2012, Krezanoski 2010). These studies found that providing an educational intervention may increase the number of adults and children using ITNs (sleeping under ITNs), compared to controls (Summary of findings for the main comparison).

Comparison 1: Malaria education versus an attention placebo of diarrhea education

De La Cruz 2009, conducted through a microfinance association that uses a 'Credit with Education' program in rural Ghana, compared three groups. One group of clients of the microfinance association received education about malaria; another group of clients received education about diarrhea prevention; and a third group from the same communities who were not clients of the microfinance association did not receive any educational intervention. Participants in the third group were not randomly selected and therefore have not been included in this review.

The malaria education curriculum consisted of 10 interactive sessions between 40 minutes and one hour in duration. The sessions included topics such as malaria transmission, where ITNs are sold, developing a plan to increase ITN use, identifying signs

of serious malaria, the importance of chemoprophylaxis during pregnancy, and actions to improve prevention and treatment of malaria in the community (De La Cruz 2009). Participants who received diarrhea education learned about preventing and treating diarrhea through seven sessions. The follow-up time was approximately two years.

Ownership

Participation in malaria education sessions may increase ownership of ITNs (RR 2.01, 95% CI 1.08 to 3.74, low-certainty evidence), compared to participating in diarrhea education sessions (Analysis 15.1) (De La Cruz 2009).

Appropriate use

Providing education about malaria to parents may increase use of ITNs, measured by the number of children sleeping under an ITN (RR 2.36, 95% CI 1.02 to 5.46, low-certainty evidence), compared to providing diarrhea education (De La Cruz 2009) (Analysis 15.2).

Secondary outcomes

This study did not report on any of the secondary outcomes for the review.

Comparison 2: Malaria education for heads of households versus no education

The Deribew 2012 study was conducted in a malaria-endemic area in Ethiopia. The intervention included free ITNs and training for the heads of households on the appropriate use of ITNs. The comparison group received free ITNs but no training. Nine intervention village residents received a five-day training course for trainers on the appropriate use of ITNs. These village residents then offered training to all household heads in the intervention villages. ITN use was measured by direct observation by trained village residents (Deribew 2012).

Ownership

Ownership was not measured in this study.

Appropriate use

The study suggests that malaria education may increase ITN use among children under five years of age at both six-months follow-up (RR 1.20, 95% CI 1.16 to 1.24, low-certainty evidence) (Analysis 16.1); and twelve-months follow-up (RR 1.60, 95% CI 1.52 to 1.68, low-certainty evidence) (Deribew 2012) (Analysis 16.2), compared to diarrhea education.

Secondary outcomes

Malaria-specific morbidity in children

Children under 5 years old in the intervention group were less likely to be anemic than those in the control group at both 6-months and 12-months follow-up (Deribew 2012).

Malaria-specific morbidity in adults

In Deribew 2012, fewer participants in the intervention group reported having had a fever within the last two weeks at six-months follow-up (RR 0.29, 95% CI 0.26 to 0.31, low-certainty evidence) (Analysis 16.3); and twelve-months follow-up (RR 0.19, 95% CI 0.16 to 0.22, low-certainty evidence), compared to those in the control group (Analysis 16.4).

This study did not report on any of the other secondary outcomes.

Comparison 3: Malaria education provided by community health workers versus no education

In the cluster randomized trial conducted by [Keating 2012](#), lay or community health workers (CHWs) delivered an interpersonal communication intervention to mothers and heads of households that focused on providing information about malaria transmission and prevention through the use of ITNs. CHWs gave information about ITN repair and re-treatment, who should use ITNs, and their importance year round. The CHWs also provided information to motivate individuals to use ITNs, such as information on the effectiveness of ITNs for malaria prevention. This information was provided through house-to-house visits using visual aids and information pamphlets. Community plays and demonstrations were also held. CHWs were trained to provide on-site assistance with hanging ITNs including provision of any required materials (e.g. string, nails, or hammers) and repairing ITNs.

Ownership

This study did not report on ITN ownership.

Appropriate use

The study found that malaria education by CHWs may increase ITN use among children under five years (OR 2.24, 95% CI 1.46 to 3.44, low-certainty evidence) ([Analysis 17.2](#)) and any ITN use in the house (OR 2.06, 95% CI 1.35 to 3.14, low-certainty evidence) ([Analysis 17.1](#)), compared to no education.

Secondary outcomes

This study did not report on any of the secondary outcomes.

Comparison 4: Malaria education provided to nursing mothers versus no education

[Amaran 2012](#) provided a structured educational program based on the national malaria control program's course content ([Amaran 2012](#)). Nursing mothers from rural communities of Ogun State, Nigeria, were randomized to receive the intervention. The intervention consisted of a one-day training session of three units: malaria transmission, malaria prevention and treatment, and malaria practices. Participants were surveyed three months after the intervention to assess utilization of ITN and knowledge about malaria.

Ownership

This study did not report on ITN ownership.

Appropriate use

This study found that malaria education probably increases ITN use (self-reported), compared to no education (RR 2.29, 95% CI: 1.82 to 2.89, moderate-certainty evidence) ([Analysis 18.1](#)) ([Amaran 2012](#)).

Secondary outcomes

This study did not report on any secondary outcomes.

Comparison 5: Education with incentives versus no incentives on appropriate use of ITNs

In the cluster randomized trial by [Kreznoski 2010](#), all study participants received a free ITN. However, the intervention communities were promised an undisclosed prize at one-month

follow-up if they complied with the appropriate use of ITNs. A final follow-up home visit to assess ITN use was conducted by surveyors at six months to check for mounted ITNs.

Ownership

Participants in both groups were provided with free ITNs and there was no difference in ITN ownership between intervention and control groups ([Analysis 19.1](#)).

Appropriate use

This study found that providing incentives plus education probably leads to little to no difference in ITN use (measured by visual inspection for mounted nets) at one-month follow-up (RR 1.10, 95% CI 0.94 to 1.28, moderate-certainty evidence) and six-months follow-up (RR 1.00, 95% CI 0.95 to 1.07, moderate-certainty evidence), compared to not providing incentives ([Analysis 19.2](#)) ([Kreznoski 2010](#)).

Secondary outcomes

This study did not report on any of the secondary outcomes.

Impacts of a combination of ITN delivery mechanisms and interventions to promote the appropriate use of ITNs

One study assessed the effects of implementation factors ([Dupas 2009](#)). The interventions evaluated are described above.

Ownership

The study found there is probably little to no difference in ITN ownership between a group that received a health-framing marketing message versus no framing and a group that received a financial-framing marketing message versus no framing (moderate-certainty evidence) ([Analysis 20.1](#); [Analysis 21.1](#)). Additionally, there is probably little to no difference in ITN ownership when vouchers are given to either female heads versus both heads jointly or male heads versus both heads jointly or when there is a verbal commitment to purchase an ITN versus no verbal commitment ([Analysis 22.1](#), [Analysis 23.1](#), [Analysis 24.1](#), moderate-certainty evidence) ([Dupas 2009](#)).

Appropriate use

The study found there is probably little to no difference in appropriate ITN use between a group that received a health-framing marketing message versus no framing and a group that received a financial-framing marketing message versus no framing ([Analysis 20.2](#); [Analysis 21.2](#), moderate-certainty evidence). Additionally, there is probably little to no difference in appropriate ITN use when vouchers are given to either female household heads versus both heads jointly or male heads versus both heads jointly or when there is a verbal commitment to purchase an ITN versus no verbal commitment ([Analysis 22.2](#), [Analysis 23.2](#), [Analysis 24.2](#), moderate-certainty evidence) ([Dupas 2009](#)).

Secondary outcomes

Secondary outcomes were not assessed for this comparison.

Adverse Effects

None of the included studies reported on adverse effects of the intervention.

DISCUSSION

Summary of main results

The five included studies that examined the impact of ITN price on ownership found that ownership was highest when ITNs were available free, which indicates that ITNs may be acquired by those in lower socioeconomic groups when the cost is decreased (Cohen 2010; Dupas 2009; Fink 2012; Muller 2008; Tarozzi 2011). These studies varied the cost of ITNs: two provided ITNs at varying subsidized prices, one compared free ITNs distributed to pregnant women in prenatal clinics to subsidized ITNs for the general population, and two studies compared loans to free distribution (Cohen 2010; Dupas 2009; Fink 2012; Muller 2008; Tarozzi 2011).

Secondly, education about the appropriate use of ITNs may increase appropriate use, compared to no education intervention or an attention placebo (diarrhea education). This effect was found regardless of whether ITNs were available free or for a cost within the community (De La Cruz 2009), and when education was tailored for the household heads (Deribew 2012), or given to mothers (Amoran 2012). Thirdly, ITN use was not affected by other factors such as whether an incentive (such as prizes) was offered (Kreznoski 2010).

Four studies failed to confirm the hypothesis that people who purchase nets will use them more than those who receive them free (Cohen 2010; Dupas 2009; Fink 2012; Tarozzi 2011). These studies show that there is probably little or no difference in rates of ITN use among those who receive a free ITN compared to those who pay for one.

Overall completeness and applicability of evidence

The studies included in this review are very heterogeneous. The studies were conducted in diverse populations in low- and middle-income countries, with nine of the ten studies undertaken in rural Africa (Amoran 2012; Cohen 2010; De La Cruz 2009; Deribew 2012; Dupas 2009; Fink 2012; Keating 2012; Kreznoski 2010; Muller 2008) and one in rural India (Tarozzi 2011). Geographic location may impact the effectiveness of ownership and use strategies, depending on the burden of malaria in that setting.

A recent survey, conducted in Ethiopia, indicates that it may not be enough to educate people about appropriate use of ITNs unless other potential barriers are identified and addressed. Respondents reported not using an ITN the previous night for the following reasons: the ITN was considered to be too old, too badly damaged, too dirty, or unavailable for use because it was being cleaned (Batisso 2012). Our review did not identify barriers preventing ITN use as we focused on interventions to promote use. However, the findings of Batisso 2012 are important for identifying the reasons ITNs are not used.

There were not enough data available in the included studies to assess the impact of different strategies on the equity ratio of household ownership and appropriate use of ITNs. Two studies reported on observational analyses of household wealth and ITN ownership and use: Dupas 2009 found that baseline wealth and financial access predict ITN ownership but, once purchased, they do not predict ITNs' use. Keating 2012 found little to no difference in ITN use by children according to household wealth. However, this information was not presented separately for intervention and control groups.

None of the included studies reported on whether the authors looked for or found any evidence relating to adverse effects. However, interventions that provide subsidized or free ITNs to the community may create resource allocation issues by diverting resources from other priority issues to ITN delivery strategies.

Quality of the evidence

Most of the included studies were well-designed cluster randomized studies that provided very detailed descriptions of the methods used and were assessed to be at low risk of bias (Figure 3). The risk of bias was high for blinding of participants for all studies (Figure 4) since all study participants were aware of their assignment to delivery strategies such as free ITNs or education about ITNs. One study was assessed as high risk of bias because of contamination between study groups (Keating 2012).

Potential biases in the review process

Publication bias was not explored formally in this review as we had too few studies to develop a meaningful funnel plot. Studies with negative findings may be reported in the gray literature rather than peer-reviewed journals. We tried to minimize this risk by using a comprehensive search strategy including searching numerous gray literature sources and websites, and contacting experts.

Six of the included studies had missing data and required additional information from the authors (Cohen 2010; De La Cruz 2009; Dupas 2009; Fink 2012; Muller 2008; Tarozzi 2011). This information related to adjusting for clustering, relative risk calculations, random sequence generation, and allocation concealment. The authors of six of these studies provided the additional data needed to complete this review.

We attempted to reduce additional sources of bias through the development of a logic model. This model helped us to clearly define our search terms and develop our inclusion/exclusion criteria, especially with regard to outcomes (Anderson 2011). We also involved a number of stakeholders in the development of the logic model which led to a more robust model (Kellogg 2004).

Agreements and disagreements with other studies or reviews

Previous systematic reviews by Willey and colleagues reviewed the scale-up of different malaria prevention strategies, including ITNs, intermittent preventive treatment in pregnancy, and artemisinin combination treatment (Willey 2010; Willey 2012). These reviews included both qualitative and quantitative study designs. The Willey 2012 review included nine studies that reported an equity ratio for ITN ownership according to socioeconomic status and found that ownership was highest among households in the poorest quintile in four studies and higher in the least poor quintile in five studies. Both reviews by Willey and colleagues found that strategies which delivered free ITNs achieved high ownership and use, and this is in agreement with the results of this review. Although we were unable to determine the equity ratio of ITN ownership, an equity effect is consistent with our results that ITN ownership is higher when ITNs are available free or at a reduced cost.

Sexton 2011 examined best practices for ITN distribution to ensure satisfactory ITN coverage and malaria control. They found that best practices included a combination of delivering free ITNs and

a "catch up" component. For example, a "catch-up" program may include free or subsidized ITN distribution during routine immunization days within areas with low coverage (Sexton 2011). This approach is in agreement with our findings that ITN ownership increases as cost decreases.

A recent survey, conducted in Nigeria, assessed the effect of a free mass distribution campaign on the equity of ITN ownership (Ye 2012). This study did not have a control group and was therefore excluded from our review. However, the study found similar results. This study concluded that free mass distribution campaigns appear to be more effective than other strategies intended to increase ITN ownership, such as social marketing campaigns and subsidized ITNs (Ye 2012).

AUTHORS' CONCLUSIONS

Implications for practice

The results of our review suggest that providing ITNs free probably increases the number of people who own ITNs, compared to providing subsidized ITNs or ITNs offered at full market price. Removing the barrier of cost improves access to ITNs for the most disadvantaged groups in a population, who are also the most at risk for malaria.

Education strategies to increase appropriate use of ITNs may increase the number of adults and children under five using ITNs. While it was not possible to identify optimal types, duration, or frequency of educational interventions, such interventions may be helpful given that 10% of those owning an ITN in sub-Saharan Africa do not report sleeping under it (WHO 2014).

Other factors to consider are the potential adverse effects of redistributing resources to provide free or subsidized ITNs. None of the studies included in our review examined the adverse microeconomic effects of interventions providing free or subsidized ITNs to the community: for example, whether funds for other health programs were redirected to cover the costs of free or highly subsidized ITNs. However, if adverse microeconomic effects exist, they almost certainly would be outweighed by the large, beneficial macroeconomic effects of reduced malaria mortality and morbidity (Gallup 2001). To maximise the benefits of ITNs, strategies to deal with unwanted or damaged ITNs and other bednets may be necessary.

Implications for research

Implications for systematic reviews

In future updates of this review, and if data are available, we plan to conduct subgroup analyses to explore heterogeneity, according to the type and number of interventions and specific population characteristics (e.g. gender/sex, ethnicity, geographic areas, rural/

urban, socioeconomic status, education, age/subgroup (children under five years and pregnant women)).

Implications for primary research

Apart from the positive effect of lower consumer cost on ownership, there was inadequate evidence to compare the relative effectiveness of competing delivery strategies such as mass free distribution versus social marketing on increasing ownership rates. Additional high quality evidence from trials is needed to identify the most effective delivery strategies.

Education about appropriate use of ITNs was shown in two studies to boost ITN use. However, this evidence is of low certainty because of the limited number of studies. Further high-quality randomized controlled trials are needed of educational interventions for appropriate ITN use. These trials should clearly describe the type and duration of the educational intervention and include larger numbers of participants in order to determine the optimal strategies for increasing ITN use. More trials are also needed on related social interventions to determine whether strategies that use social marketing, incentives, or other interventions to address behavior change are effective in increasing ownership and appropriate use of ITNs.

We would have liked to have been able to report whether there are differences in outcomes for ownership and use based on factors such as gender and household wealth. However, while two of the included studies reported on observational analyses, none of the studies reported these results by intervention group. Future trials should assess whether ownership and use of ITNs is affected by social and demographic factors.

Future randomized controlled trials should assess the longer-term sustainability of interventions to increase ownership and use of ITNs.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Amoran 2012

Methods	RCT
Participants	Mothers or guardians with children under 5 years old living in their house.
Interventions	Intervention: A one-day educational program based on the national malaria control programme and information obtained from gaps in knowledge (from a previous survey). Education included posters, story book, malaria signs (i.e.. graphics to demonstrate ITN use). Topics included knowledge about malaria, attitude on malaria prevention strategies, malaria prevention and treatment. Comparison: No education program.
Outcomes	Prevalence of ITN use; Knowledge about mounting and treating ITNs.
Notes	The authors report no conflicts of interest. No funding details provided.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A multistage random sampling technique was used: "a systematic random sampling technique using a sample intervention of five and four in the experimental and control wards respectively was used to choose two hundred houses...the sample interval was obtained by dividing the total number of houses by the sample size...the first house was determined using the table of random numbers"
Allocation concealment (selection bias)	Low risk	"It was decided to choose the experimental and control groups from two different ends (North axis and South axis) of the Local Government to prevent cross interference during and after the intervention periods. The distance between the experimental and the control group is about 10 km."
Incomplete outcome data (attrition bias) All outcomes	High risk	Dropouts not discussed.
Selective reporting (reporting bias)	Unclear risk	Protocol not provided.

Amoran 2012 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No mention of blinding.
Baseline outcome measurements	High risk	Knowledge about mounting ITNs and treatment of ITNs were much higher in the intervention group at baseline.
Other bias	High risk	No objective measure of ITNs use. Results rely on self-reported ITNs use only.

Cohen 2010

Methods	Cluster RCT
Participants	Pregnant women in rural Kenya enrolled through prenatal clinics.
Interventions	Intervention: ITNs provided at different levels of subsidy (90% to 100%). Comparison: Groups assigned to a different level of subsidy compared.
Outcomes	Proportion of prenatal clients who acquired program ITNs; Proportion of study population using ITNs at follow-up (self-reported); Proportion of study population having an ITN hanging (evidence of ITN being used); Anemia in pregnant women
Notes	In the 2008 paper, the authors note that the free ITNs may have encouraged women to walk an extra mile to go to a different clinic where they could get a free ITN instead of attending a closer clinic that was selling subsidized ITNs. Funding provided by the Mulago Foundation. Nets were provided by TAMTAM Africa. The author was funded by a National Science Foundation Graduate Research Fellowship.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomized two-stage sampling: 1. Randomization done at the clinic level with random number generation; 2. Lottery for additional discount at the clinic (offered to a subsample of women)
Allocation concealment (selection bias)	Low risk	Personal communication with author: "The randomization for the QJE paper was also done through random number generation in stata. But it was done at the clinic level, therefore it couldn't be concealed from the enumerators."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Missing data mentioned for some outcomes; however detailed discussion not provided.
Selective reporting (reporting bias)	Unclear risk	The protocol not provided.

Cohen 2010 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding was not possible due to the nature of the intervention (clinics were providing ITNs at different levels of subsidy). However, women were not told that follow-up visits could be made at their homes when baseline survey was administered and ITNs were purchased. Furthermore, the clinic staff and the enumerators conducting the baseline surveys did not know that the ITNs usage was to be evaluated.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcomes were not assessed blindly, however outcomes measured were both objective (e.g. ITNs hanging as evidence of use) and subjective (e.g. self-reported ITN use). Furthermore, clinics and study participants did not know about the follow-up visits.
Baseline outcome measurements	Unclear risk	Differences between groups at baseline are unclear.
Other bias	Unclear risk	Some leakages (mismanagement of the ITNs) observed in 4 of the 11 clinics that were asked to sell ITNs for a positive price. Participating clinics received monetary incentive for their participation in the study. Also, the similarity of the characteristics of study participants is unclear.

De La Cruz 2009

Methods	RCT
Participants	Women of reproductive age (15 to 49 years) with a child under five living in rural Ghana. All women enrolled in the intervention groups who received education were clients of a credit association. Women from the same communities who were not members of the credit association were enrolled as a control group, however, they were not randomly selected and therefore have been excluded from this review.
Interventions	Intervention: Malaria education Comparison: An attention placebo of diarrhea education
Outcomes	Participant owns at least one bednet; Participant owns at least one ITN; Proportion of children under five sleeping under ITNs; Proportion of women of reproductive age sleeping under any bednet; Proportion of women of reproductive age sleeping under any ITN; Treatment-seeking behavior for children under five with fever.
Notes	The authors conducted a cRCT to compare malaria education to diarrhea education. Clients of a credit association were randomly selected from within these villages to receive the education. Controls were selected by choosing every fifth house in a randomly selected area of the community. Funding was provided by GlaxoSmithKline Africa Malaria Partnership. The authors report no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Villages were randomly selected to participate in malaria or diarrhea education; however the method of randomization is not described. Then, partici-

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De La Cruz 2009 (Continued)

pants were randomly selected from the list of clients of a credit association to participate in the education program. The control group was not randomly selected and therefore we did not include the control group in this review.

Allocation concealment (selection bias)	Unclear risk	The method of allocation concealment is not described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The protocol not provided and the missing data not discussed.
Selective reporting (reporting bias)	Unclear risk	The protocol not provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of study participants or personnel was not mentioned.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Blinding of outcomes assessment was not mentioned.
Baseline outcome measurements	High risk	There were differences between the two regions for most variables.
Other bias	Unclear risk	Exposure to external campaigns, and contamination between the control and the intervention groups possible (respondents were asked at follow-up to list all sources from which they received malaria information).

Deribew 2012

Methods	CBA
Participants	Households from 22 randomly selected villages were enrolled in the study.
Interventions	<p>Intervention:</p> <p>Training of heads of households (education with posters, manuals and demonstrations on appropriate long-lasting (LL) ITN use);</p> <p>Free LLITN;</p> <p>Monthly monitoring of appropriate use and malaria occurrence with appropriate LLITN use training;</p> <p>Three times a year mass blood examination for anemia and malaria of children under five and pregnant women</p> <p>Comparison:</p> <p>Free LLITN;</p> <p>Monthly monitoring of malaria occurrence;</p> <p>Three times a year mass blood examination for anemia and malaria of children under five and pregnant women</p>

Deribew 2012 (Continued)

Outcomes	Proportion of households owning at least one ITN; Proportion of population sleeping under ITNs – male, female and different age groups; Proportion of pregnant women sleeping under ITNs; Proportion of children under five sleeping under ITNs; Child malaria morbidity; Anemia in pregnant women
Notes	Funding provided by UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases. The authors report no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"To avoid contamination, villages in the field research centre were stratified into North and South of the reservoir of the dam. Gots in the north direction of the reservoir were selected randomly as intervention whereas those villages in the south direction of the dam were selected to be control groups and both groups are within the same distance from the reservoir." 22 of the 52 eligible gots were randomly selected but it is unclear whether the designation of the villages north of the reservoir as intervention and those south of the reservoir as control was randomly chosen.
Allocation concealment (selection bias)	High risk	Method of allocation concealment was not described.
Incomplete outcome data (attrition bias) All outcomes	High risk	High numbers of dropouts in both intervention and control groups. The authors have not provided an explanation.
Selective reporting (reporting bias)	Low risk	None detected.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding not mentioned but not possible. Participants and personnel would have been aware of the intervention.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors were the same people as those who conducted the intervention therefore blinding is not possible and could bias the results.
Baseline outcome measurements	High risk	More women in the control villages than intervention villages were using ITNs.
Adequate protection from contamination	Low risk	Villages were separated by physical space with villages in one area designated as controls and those in another designated as intervention groups.
Other bias	Low risk	Other bias not observed.

Dupas 2009

Methods	Cluster RCT
Participants	Households in rural Kenya
Interventions	Intervention: Households were assigned to:

Dupas 2009 (Continued)

1. A subsidy level (40% to 100%);
2. One of three “marketing” groups (“health framing”, “financial framing” and no marketing message);
3. One of two “commitment” groups (verbal commitment; no verbal commitment to buy LLITN);
4. One of three “targeting” groups (voucher given to female head of the household, male head or both heads)

Single-headed households were excluded.

Comparison: The intervention groups above were compared with one another.

Outcomes	Proportion of population sleeping under ITNs; Proportion of children sleeping under ITNs - evaluated as bednets hanging and self-report.
Notes	The study was funded by the Acumen Fund, Adessium Foundation, and Exxon Mobil Foundation. Olyset nets were donated by the manufacturer Sumitomo Chemical.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomization was done through random number generation.
Allocation concealment (selection bias)	Low risk	Allocation performed centrally.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The proportion of missing data in the intervention and control group not specified.
Selective reporting (reporting bias)	Unclear risk	The protocol not provided. No evidence of selective outcome reporting; however change from baseline for each group not reported.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding not mentioned.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcomes were not assessed blindly, however outcomes measured were both objective (e.g. ITNs hanging as evidence of use) and subjective (e.g. self-reported ITN use).
Baseline outcome measurements	Unclear risk	Similarity of baseline characteristics of study participants in each group not reported (baseline characteristics provided for the whole study population; not specified if participants in the intervention and the comparison groups are similar).
Other bias	Low risk	Other bias not observed.

Fink 2012

Methods	Three-arm cluster RCT
Participants	Heads of households from farming families in rural Katete District of Zambia

Fink 2012 (Continued)

Interventions	Intervention: In the free group, households could receive one ITN for each sleeping space. In the loan group, households could get ITNs at 50% subsidized cost with repayment due at the end of the harvest-ing season. The maximum number of ITNs each household could receive was restricted to the number of sleeping spaces in the household. Comparison: ITNs available at market price.
Outcomes	Nets owned per household; Net use as seen by interviewers at follow-up; Diagnosed malaria
Notes	Funding was provided by the William F. Milton Fund. The authors report no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence genera-tion (selection bias)	Low risk	Authors state "Using the STATA 9 statistical software package, clusters were randomly assigned / based on a random number draw generated by the STATA 9 statistical software package"
Allocation concealment (selection bias)	Low risk	The method of concealment is not described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The protocol not provided. The proportion of missing data in the intervention and control group not specified.
Selective reporting (re- porting bias)	Unclear risk	The protocol not provided.
Blinding of participants and personnel (perfor-mance bias) All outcomes	High risk	Blinding not mentioned.
Blinding of outcome as-sessment (detection bias) All outcomes	High risk	Blinding not mentioned.
Baseline outcome mea-surements	Unclear risk	Some differences between groups at baseline. There are fewer women in the control group; the control group had fewer sleeping spaces; and the free group had fewer ITNs.
Other bias	Low risk	No other bias observed.

Keating 2012

Methods	Cluster RCT
Participants	Households in Luangwa District, Zambia
Interventions	Intervention: Community-based interpersonal communication intervention delivered through community health workers (CHWs). CHWs provided information about malaria transmission, prevention, and ITNs. CHWs delivered the intervention house to house and used visual aids, printed materials, provided information to motivate individuals to use ITNs. CHWs provided on-site assistance with net deployment including providing necessary equipment (string, hammer, nails, etc.) and net repair. CHWs did not provide nets but explained where to get one when asked.

Keating 2012 (Continued)

Comparison: CHWs provided an HIV awareness campaign.

Outcomes	Proportion of children < 5 years old sleeping under ITN the night before the survey.
Notes	Funding provided by the Centers for Disease Control and Prevention and the PATH Malaria Control and Evaluation Partnership in Africa. The authors report no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Methods not described. Author states "the unit of randomizations was the CHW catchment area. Random sampling was used to assign 60 CHWs to the treatment group and 40 to serve as the control group. (Note: an error in communication and implementation led to 10 additional CHWs receiving the control group training). In the interest of minimizing additional bias, CHWs were not re-randomised, as trainings had already started."
Allocation concealment (selection bias)	Low risk	The method of concealment is not described however requirements for inclusion of clusters was minimum 3 km distance between villages to minimize spill over.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not specified.
Selective reporting (reporting bias)	Unclear risk	The protocol not provided.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Blinding not mentioned
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding not mentioned
Baseline outcome measurements	High risk	ITN use was much higher in the intervention group at baseline.
Other bias	High risk	Contamination - ITN use increased across both arms between 2008 and 2010. Only 47% of children in the intervention communities received the intervention and 30.6% in the control areas received the intervention.

Krezanoski 2010

Methods	Cluster RCT
Participants	Households in rural Madagascar
Interventions	Intervention: Voucher for an ITN and undisclosed "prize" promised for appropriate use Comparison: Voucher for an ITN; no incentive promised
Outcomes	Proportion of households with at least one ITN; ITNs mounted

Kreznoski 2010 (Continued)

Notes Program funds were provided by the International Health Summer Scholarship from the Boston University School of Medicine. The authors report no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Alphabetical list of villages created and randomization performed by throwing a dice.
Allocation concealment (selection bias)	Low risk	Centralized randomization performed.
Incomplete outcome data (attrition bias) All outcomes	Low risk	The study mentioned that in case of missing data, surveyors needed to return to the field to collect the missing data; however further details not provided. Quote: "The overall loss to follow up rate was similar for both arms over the six-month study (10% in the intervention group vs. 12% in the control group)."
Selective reporting (reporting bias)	Unclear risk	The protocol not provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and personnel not discussed in the study.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Blinding of outcome assessment not discussed in the study.
Baseline outcome measurements	Low risk	There were no major differences between groups at baseline.
Other bias	Low risk	Other bias not observed.

Muller 2008

Methods	Cluster RCT
Participants	Pregnant women and households in rural Burkina Faso.
Interventions	Intervention A: Access to subsidized ITNs in the whole study area + free distribution of ITNs to pregnant women through prenatal clinics + social marketing Intervention B: Access to subsidized ITNs in the whole study area + social marketing
Outcomes	Primary outcomes: overall program ITN ownership in households (total number of households with at least one observed Serena ITN, and total number of observed Serena ITNs). Secondary outcomes: overall bednet and ITN ownership of households, total number of bednets, and bednet use.
Notes	Funded by the Deutsche Forschungsgemeinschaft (SFB544 'Control of Tropical Infectious Diseases' at the Ruprecht-Karls-University Heidelberg). The authors report no conflicts of interest.

Risk of bias

Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria (Review)

Muller 2008 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Twenty-four clusters (catchment areas of peripheral health centres) were randomized to intervention groups. Method was specified in the protocol but not described in detail: "By using standard two-stage EPI cluster sampling methodology, 500 randomly sampled households from the intervention A area and 500 randomly sampled households from the intervention B area will be visited before the start of the intervention (February 2006)."
Allocation concealment (selection bias)	Low risk	The method of concealment is not described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The missing outcome data mentioned; however details not provided.
Selective reporting (reporting bias)	High risk	Some outcomes mentioned in the protocol were not reported in the final publication.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of outcome assessment not mentioned; contamination possible (pregnant women aware of free ITN distribution could have visited clinics that were distributing free ITNs)
Blinding of outcome assessment (detection bias) All outcomes	High risk	Blinding of outcome assessment not mentioned.
Baseline outcome measurements	High risk	There were differences between participants in the two regions for most variables.
Other bias	Low risk	No other risks of bias observed.

Tarozzi 2011

Methods	Cluster RCT
Participants	Rural Indian population – clients and non-clients of non-governmental organization Bharat Integrated Social Welfare Agency (BISWA) that offers microfinance services to under-privileged populations.
Interventions	<p>Intervention:</p> <p>1. Microlender BISWA offered contracts for the purchase of ITNs and re-treatments (ITN price was not subsidized);</p> <p>Brief information campaign on malaria and ITNs.</p> <p>2. Free ITNs;</p> <p>Brief information campaign on malaria and ITNs.</p> <p>Comparison: No ITN distribution program or education on malaria and ITNs.</p>
Outcomes	Proportion of households with at least one ITN; Proportion of population sleeping under ITNs
Notes	Study partially funded by the National Institute of Allergy and Infectious Diseases and a Marie Curie International Incoming Fellowship.

Tarozzi 2011 (Continued)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Villages were drawn by means of a pseudo-random number generator, and the selection algorithm ensured the inclusion of a multiple of three villages from each block. After the completion of the baseline survey, one-third of villages within each block were then randomly assigned to each experimental arm. Randomization method for this step was not described.
Allocation concealment (selection bias)	Low risk	The method of concealment is not described.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The protocol not provided. Outcomes measured before and after the intervention described and differences justified.
Selective reporting (reporting bias)	Unclear risk	The protocol not provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and personnel not mentioned.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Blinding of outcome assessment not mentioned.
Baseline outcome measurements	Low risk	There were no major differences between groups at baseline.
Other bias	Unclear risk	Clients of BISWA microlender may have different characteristics than non-clients recruited into the study.

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Alaii 2003	Coverage data came from external sources and were obtained from other sources (e.g. national surveys). The authors were contacted and supplemental data published elsewhere confirmed that this study did not meet inclusion criteria.
Binka 1996	While the study included home visits to a random sample of 5% of the study population to assess ITN use, the purpose of the study was to assess the efficacy of permethrin-treated ITNs in preventing child mortality, not to assess a strategy to increase ownership, with or without use.
Geounuppakul 2007	The study does not meet the study design inclusion criteria; it is a controlled before-and-after study with only one intervention group and one control group.
Goodson 2012	This study used propensity score matching and therefore did not meet our study design inclusion criteria and was excluded.
Hoffmann 2009	This study aimed to determine willingness to pay for ITN. Our primary and secondary outcomes were not measured therefore this study was excluded.

Study	Reason for exclusion
Vijayakumar 2009	The study does not meet the study design inclusion criteria as all study participants received the same intervention. The researchers compared the change in behavior between two different groups of study participants and their change in behavior after they had received the same intervention. At baseline, one group of study participants already had an ongoing ITN programme in place, whereas the other group did not.
Ye 2012	This study did not contain a control group and did not meet EPOC study design inclusion criteria and was therefore excluded.
Yilma 2012	This study used propensity score matching and therefore did not meet our study design inclusion criteria and was excluded.

Characteristics of studies awaiting assessment *[ordered by study ID]*

Soleimani Ahmadi 2012

Methods	Cluster RCT
Participants	Residents of 14 rural villages in the Bashagard District of Iran. Education programs delivered to mothers.
Interventions	Four phases: ITNs were distributed free to all households (LLITNs to intervention areas and plain nets to control areas); baseline knowledge and practice survey was conducted after net distribution; education programs were held for mothers in the intervention group (education about transmission and prevention of malaria, benefits of ITNs, appropriate time of ITN use and bednet maintenance); and finally intervention group participants completed the same survey from before the intervention.
Outcomes	Knowledge about malaria transmission; Practice regarding ITN use (regular use, hanging time, hanging place, washing frequency)
Notes	ITN use in the "overnight" period increased in both intervention and control groups post-intervention. Use during "sleeping time, 9:00-12pm" decreased in both groups. The author was contacted for clarification on the definition of these outcomes. We have not received a reply and therefore cannot assess the results of this study at this time.

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

Kilian 2012

Trial name or title	Five clusters (parishes) per intervention arm from subcounties which did not receive a previous campaign. 750 households per arm.
Methods	Cluster RCT
Participants	Households in Kamuli District of Uganda.
Interventions	Intervention One arm had a volunteer visit two days after the campaign and again at three months. Second arm had volunteer visit two days after the campaign, at three months, and at six months.

Kilian 2012 (Continued)

Comparison

One volunteer visit six months after campaign.

Outcomes	ITN ownership; Hanging of ITNs
Starting date	2010
Contact information	Albert Kilian albert@trophealth.com
Notes	Received unpublished study protocol and presentation slides containing unpublished study results. Trial will be published in early 2013 (personal communication with lead author Albert Kilian).

Siekman 2012

Trial name or title	Effectiveness of post-campaign hang-up intervention to increase ITN utilization in Togo: a cluster randomized control trial
Methods	Cluster RCT
Participants	1440 Households from cantons randomly allocated to three study arms
Interventions	Intervention Post-campaign home visits by volunteers to enhance ITN hang-up and utilization Comparison No additional interventions after campaign
Outcomes	ITN utilization: Proportion sleeping under ITN previous night (confirmed by hang-up volunteer visit)
Starting date	Unknown
Contact information	Kendra Siekmans ksiekman@healthbridge.ca, Health and Nutrition Specialist, Healthbridge
Notes	First evaluation completed, have completed data collection on second evaluation and have a third evaluation planned for 2012.

DATA AND ANALYSES

Comparison 1. ITN Price: free vs. KES 210 to 300

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 Use (ITN seen hanging after 2 months, if purchased)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by adults	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 1.1. Comparison 1 ITN Price: free vs. KES 210 to 300, Outcome 1 Ownership (purchased net).

Study or subgroup	Free n/N	200-300Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	15/185		0%	12.15[7.47,19.75]
Favours 200-300Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 1.2. Comparison 1 ITN Price: free vs. KES 210 to 300, Outcome 2 Use (ITN seen hanging after 2 months, if purchased).

Study or subgroup	Free n/N	210-300Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	41/66	6/13		0%	1.35[0.73,2.49]
Favours 210-300Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 1.3. Comparison 1 ITN Price: free vs. KES 210 to 300, Outcome 3 ITN used by children.

Study or subgroup	Free n/N	210-300Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	31/66	3/13		0%	2.04[0.73,5.67]
Favours 210-300 Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 1.4. Comparison 1 ITN Price: free vs. KES 210 to 300, Outcome 4 ITN used by adults.

Study or subgroup	Free n/N	210-300 Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	24/66	4/13		0%	1.18[0.49,2.84]
Favours 210-300 Ksh 0.01 0.1 1 10 100 Favours free					

Comparison 2. ITN Price: free vs. KES 160 to 200

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Use (ITN seen hanging after 2 months, if purchased)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by adults	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 2.1. Comparison 2 ITN Price: free vs. KES 160 to 200, Outcome 1 Ownership (purchased net).

Study or subgroup	Free n/N	160-200Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	30/210		0%	6.9[4.94,9.62]

Analysis 2.2. Comparison 2 ITN Price: free vs. KES 160 to 200, Outcome 2 Use (ITN seen hanging after 2 months, if purchased).

Study or subgroup	Free n/N	160-200Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	41/66	11/29		0%	1.64[0.99,2.71]

Analysis 2.3. Comparison 2 ITN Price: free vs. KES 160 to 200, Outcome 3 ITN used by children.

Study or subgroup	Free n/N	160-200Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	31/66	6/29		0%	2.27[1.06,4.84]

Analysis 2.4. Comparison 2 ITN Price: free vs. KES 160 to 200, Outcome 4 ITN used by adults.

Study or subgroup	Free n/N	160-200Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	24/66	9/29		0%	1.17[0.62,2.2]

Comparison 3. ITN Price: free vs. KES 100 to 150

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Use (ITN seen hanging after 2 months, if purchased)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by adults	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 3.1. Comparison 3 ITN Price: free vs. KES 100 to 150, Outcome 1 Ownership (purchased net).

Study or subgroup	Free n/N	100-150Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	126/441		0%	3.45[2.97,4.01]
Favours 100-150Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 3.2. Comparison 3 ITN Price: free vs. KES 100 to 150, Outcome 2 Use (ITN seen hanging after 2 months, if purchased).

Study or subgroup	Free n/N	100-150 Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	41/66	65/116		0%	1.11[0.87,1.42]
Favours 100-150 Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 3.3. Comparison 3 ITN Price: free vs. KES 100 to 150, Outcome 3 ITN used by children.

Study or subgroup	Free n/N	100-150 Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	31/66	37/116		0%	1.47[1.02,2.13]
Favours 100-150Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 3.4. Comparison 3 ITN Price: free vs. KES 100 to 150, Outcome 4 ITN used by adults.

Study or subgroup	Free n/N	100-150Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	24/66	46/116		0%	0.92[0.62,1.35]
Favours 100-150Ksh 0.01 0.1 1 10 100 Favours free					

Comparison 4. ITN Price: free vs. KES 70 to 90

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Use (ITN seen hanging after 2 months, if purchased)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by adults	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 4.1. Comparison 4 ITN Price: free vs. KES 70 to 90, Outcome 1 Ownership (purchased net).

Study or subgroup	Free n/N	70-90Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	107/212	+	0%	1.95[1.7,2.24]
Favours 70-90Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 4.2. Comparison 4 ITN Price: free vs. KES 70 to 90, Outcome 2 Use (ITN seen hanging after 2 months, if purchased).

Study or subgroup	Free n/N	70-90Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	41/66	62/98	+	0%	0.98[0.77,1.25]
Favours 70-90Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 4.3. Comparison 4 ITN Price: free vs. KES 70 to 90, Outcome 3 ITN used by children.

Study or subgroup	Free n/N	70-90Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	31/66	36/98	++	0%	1.28[0.89,1.84]
Favours 70-90Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 4.4. Comparison 4 ITN Price: free vs. KES 70 to 90, Outcome 4 ITN used by adults.

Study or subgroup	Free n/N	70-90Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	24/66	47/98	++	0%	0.76[0.52,1.11]
Favours 70-90Ksh 0.01 0.1 1 10 100 Favours free					

Comparison 5. ITN Price: free vs. KES 40 to 60

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Use (ITN seen hanging after 2 months, if purchased)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by adults	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 5.1. Comparison 5 ITN Price: free vs. KES 40 to 60, Outcome 1 Ownership (purchased net).

Study or subgroup	Free n/N	40-60Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	120/174	+	0%	1.43[1.29,1.58]
Favours 40-60Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 5.2. Comparison 5 ITN Price: free vs. KES 40 to 60, Outcome 2 Use (ITN seen hanging after 2 months, if purchased).

Study or subgroup	Free n/N	40-60Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	41/66	65/111	+	0%	1.06[0.83,1.36]
Favours 40-60 Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 5.3. Comparison 5 ITN Price: free vs. KES 40 to 60, Outcome 3 ITN used by children.

Study or subgroup	Free n/N	40-60 Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	31/66	38/111	+	0%	1.37[0.95,1.97]
Favours 40-60Ksh 0.01 0.1 1 10 100 Favours free					

Analysis 5.4. Comparison 5 ITN Price: free vs. KES 40 to 60, Outcome 4 ITN used by adults.

Study or subgroup	Free n/N	40-60Ksh n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	24/66	47/111	+	0%	0.86[0.58,1.26]
Favours 40-60 Ksh 0.01 0.1 1 10 100 Favours free					

Comparison 6. ITN Price: free vs. any price (KES 40 to 300)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 ITN ownership (purchased net)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 6.1. Comparison 6 ITN Price: free vs. any price (KES 40 to 300), Outcome 1 ITN ownership (purchased net).

Study or subgroup	Free n/N	Any cost n/N	Risk Ratio M-H, Random, 95% CI		Weight	Risk Ratio M-H, Random, 95% CI
Dupas 2009	66/67	398/1222		+	0%	3.02[2.78,3.3]
<div style="display: flex; justify-content: space-between; align-items: center;"> Favours any cost 0.01 0.1 1 10 100 Favours free </div>						

Comparison 7. ITN price: free vs. KES 40

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (measured as a share of prenatal clients who acquired program ITN)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITNs use (self reported at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN use (net seen hanging at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 7.1. Comparison 7 ITN price: free vs. KES 40, Outcome 1 Ownership (measured as a share of prenatal clients who acquired program ITN).

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	4.4 (0.754)		0%	78.75[17.98,344.99]
<div style="display: flex; justify-content: space-between; align-items: center;"> Favours free 0.01 0.1 1 10 100 Favours 40 Ksh </div>						

Analysis 7.2. Comparison 7 ITN price: free vs. KES 40, Outcome 2 ITNs use (self reported at follow-up).

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	-0.3 (0.492)		0%	0.71[0.27,1.87]
<div style="display: flex; justify-content: space-between; align-items: center;"> Favours free 0.01 0.1 1 10 100 Favours 40 Ksh </div>						

Analysis 7.3. Comparison 7 ITN price: free vs. KES 40, Outcome 3 ITN use (net seen hanging at follow-up).

Study or subgroup	40 Ksh N	Free N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	-0.3 (0.479)		0%	0.72[0.28,1.83]
			Favours free	0.01 0.1 1 10 100	Favours 40 Ksh	

Comparison 8. ITN price: free vs. KES 20

Outcome or subgroup title	No. of studies	No. of parti- cips	Statistical method	Effect size
1 Ownership (measured as a share of prenatal clients who acquired program ITN)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITNs use (self reported at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN use (net seen hanging at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 8.1. Comparison 8 ITN price: free vs. KES 20, Outcome 1 Ownership (measured as a share of prenatal clients who acquired program ITN).

Study or subgroup	20 Ksh N	Free N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	2.4 (0.752)		0%	10.89[2.49,47.56]
			Favours free	0.01 0.1 1 10 100	Favours 20 Ksh	

Analysis 8.2. Comparison 8 ITN price: free vs. KES 20, Outcome 2 ITNs use (self reported at follow-up).

Study or subgroup	20 Ksh N	Free N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	0.3 (0.401)		0%	1.3[0.59,2.86]
			Favours free	0.01 0.1 1 10 100	Favours 20 Ksh	

Analysis 8.3. Comparison 8 ITN price: free vs. KES 20, Outcome 3 ITN use (net seen hanging at follow-up).

Study or subgroup	20 Ksh N	Free N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	0.3 (0.391)		0%	1.42[0.66,3.05]
			Favours free	0.01 0.1 1 10 100	Favours 20 Ksh	

Comparison 9. ITN price: free vs. KES 10

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (measured as a share of prenatal clients who acquired program ITN)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITNs use (self-reported at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN use (net seen hanging at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 9.1. Comparison 9 ITN price: free vs. KES 10, Outcome 1 Ownership (measured as a share of prenatal clients who acquired program ITN).

Study or subgroup	Favours free N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	1.4 (0.787)		0%	4.08[0.87,19.08]
Favours free 0.01 0.1 1 10 100 Favours 10 Ksh						

Analysis 9.2. Comparison 9 ITN price: free vs. KES 10, Outcome 2 ITNs use (self-reported at follow-up).

Study or subgroup	Favours free N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	0.6 (0.378)		0%	1.77[0.85,3.72]
Favours free 0.01 0.1 1 10 100 Favours 10 Ksh						

Analysis 9.3. Comparison 9 ITN price: free vs. KES 10, Outcome 3 ITN use (net seen hanging at follow-up).

Study or subgroup	10 Ksh N	Free N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Cohen 2010	0	0	0.6 (0.374)		0%	1.86[0.89,3.88]
Favours free 0.01 0.1 1 10 100 Favours 10 Ksh						

Comparison 10. ITN price: free vs any cost (KES 10 to 40)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 ITN ownership	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 10.1. Comparison 10 ITN price: free vs any cost (KES 10 to 40), Outcome 1 ITN ownership.

Study or subgroup	Free n/N	10-40 Ksh n/N	Risk Ratio M-H, Random, 95% CI		Weight	Risk Ratio M-H, Random, 95% CI
Cohen 2010	576/587	1146/1502			0%	1.29[1.25,1.33]
			Favours free		Favours 10-40 Ksh	

Comparison 11. Free ITNs, access to subsidized ITNs and social marketing vs. access to subsidized ITNs and social marketing

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 No of households with at least one intervention ITN	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Number of households with at least one ITN	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 Last night of bednet (%)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 11.1. Comparison 11 Free ITNs, access to subsidized ITNs and social marketing vs. access to subsidized ITNs and social marketing, Outcome 1 No of households with at least one intervention ITN.

Study or subgroup	Free n/N	Subsidized n/N	Risk Ratio M-H, Random, 95% CI		Weight	Risk Ratio M-H, Random, 95% CI
Muller 2008	85/243	49/244			0%	1.74[1.29,2.36]
			Favours Subsidized		Favours Free	

Analysis 11.2. Comparison 11 Free ITNs, access to subsidized ITNs and social marketing vs. access to subsidized ITNs and social marketing, Outcome 2 Number of households with at least one ITN.

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI		Weight	Risk Ratio M-H, Random, 95% CI
Muller 2008	105/243	90/289			0%	1.39[1.11,1.74]
			Favours control		Favours experimental	

Analysis 11.3. Comparison 11 Free ITNs, access to subsidized ITNs and social marketing vs. access to subsidized ITNs and social marketing, Outcome 3 Last night of bednet (%).

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI		Weight	Risk Ratio M-H, Random, 95% CI
Muller 2008	108/322	155/392			0%	0.85[0.7,1.03]
			Favours control		Favours experimental	

Comparison 12. Free ITN vs. Control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Nets owned per household (measured as nets owned)	2	1489	Std. Mean Difference (IV, Random, 95% CI)	0.69 [0.39, 0.99]
2 Use (nets used per household, seen at follow-up)	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
3 Usual ITN use in peak season	1		Risk Ratio (Random, 95% CI)	Subtotals only
4 Slept under a net the night before the survey	1		Risk Ratio (Random, 95% CI)	Subtotals only
5 Malaria positive (total)	1		Risk Ratio (Random, 95% CI)	Subtotals only
6 Anaemia (Hb< 11g/dL)	1		Risk Ratio (Random, 95% CI)	Subtotals only

Analysis 12.1. Comparison 12 Free ITN vs. Control, Outcome 1 Nets owned per household (measured as nets owned).

Study or subgroup	Free		Control		Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
	N	Mean(SD)	N	Mean(SD)			
Fink 2012	158	2.6 (1.3)	161	1 (2.2)		44.54%	0.86[0.63,1.09]
Tarozzi 2011	610	1.6 (2.7)	560	0.3 (1.7)		55.46%	0.55[0.44,0.67]
Total ***	768		721			100%	0.69[0.39,0.99]
Heterogeneity: Tau ² =0.04; Chi ² =5.38, df=1(P=0.02); I ² =81.42%							
Test for overall effect: Z=4.56(P<0.0001)

Analysis 12.2. Comparison 12 Free ITN vs. Control, Outcome 2 Use (nets used per household, seen at follow-up).

Study or subgroup	Free		Control		Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
	N	Mean(SD)	N	Mean(SD)			
Fink 2012	158	2.4 (1.5)	161	1 (1.9)		0%	1.42[1.04,1.8]

Analysis 12.3. Comparison 12 Free ITN vs. Control, Outcome 3 Usual ITN use in peak season.

Study or subgroup	Free N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
Tarozzi 2011	0	0	0.7 (0.063)		0%	2.03[1.79,2.29]
Favours control					Favours control	

Analysis 12.4. Comparison 12 Free ITN vs. Control, Outcome 4 Slept under a net the night before the survey.

Study or subgroup	Free N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
Tarozzi 2011	0	0	-0 (0.029)		0%	0.98[0.93,1.04]
Favours control					Favours free	

Analysis 12.5. Comparison 12 Free ITN vs. Control, Outcome 5 Malaria positive (total).

Study or subgroup	Free N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
Tarozzi 2011	0	0	0.1 (0.042)		0%	1.06[0.97,1.15]
Malaria positive free					Malaria positive control	

Analysis 12.6. Comparison 12 Free ITN vs. Control, Outcome 6 Anaemia (Hb< 11g/dL).

Study or subgroup	Free N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
Tarozzi 2011	0	0	-0 (0.033)		0%	0.97[0.91,1.04]
Free worse					Control worse	

Comparison 13. Microfinancing for nets vs. Control

Outcome or subgroup title	No. of studies	No. of partici- pants	Statistical method	Effect size
1 Nets owned per household (measured as nets owned)	2	1507	Std. Mean Difference (IV, Random, 95% CI)	0.29 [-0.06, 0.63]
2 Use (nets used per household, seen at follow-up)	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
3 Usual ITN use in peak season	1		Risk Ratio (Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4 Slept under a net the night before the survey	1		Risk Ratio (Random, 95% CI)	Subtotals only
5 Malaria positive (total)	1		Risk Ratio (Random, 95% CI)	Subtotals only
6 Anaemia (Hb< 11g/dL)	1		Risk Ratio (Random, 95% CI)	Subtotals only

Analysis 13.1. Comparison 13 Microfinancing for nets vs. Control, Outcome 1 Nets owned per household (measured as nets owned).

Analysis 13.2. Comparison 13 Microfinancing for nets vs. Control, Outcome 2 Use (nets used per household, seen at follow-up).

Analysis 13.3. Comparison 13 Microfinancing for nets vs. Control, Outcome 3 Usual ITN use in peak season.

Analysis 13.4. Comparison 13 Microfinancing for nets vs. Control, Outcome 4 Slept under a net the night before the survey.

Analysis 13.5. Comparison 13 Microfinancing for nets vs. Control, Outcome 5 Malaria positive (total).

Analysis 13.6. Comparison 13 Microfinancing for nets vs. Control, Outcome 6 Anaemia (Hb< 11g/dL).

Comparison 14. Free ITN vs. Microfinancing for nets

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Nets owned per capita (measured as nets owned)	2	1554	Std. Mean Difference (IV, Random, 95% CI)	0.37 [0.27, 0.47]
2 Use (nets used per household, seen at follow-up)	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
3 Usual ITN use in peak season	1		Odds Ratio (Random, 95% CI)	Subtotals only
4 Slept under a net the night before the survey	1		Odds Ratio (Random, 95% CI)	Subtotals only
5 Malaria positive (total)	2		Odds Ratio (Random, 95% CI)	1.07 [0.96, 1.20]
6 Malaria positive (children under 15)	1		Odds Ratio (Random, 95% CI)	Subtotals only
7 Anaemia (Hb< 11g/dL)	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 14.1. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 1 Nets owned per capita (measured as nets owned).

Analysis 14.2. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 2 Use (nets used per household, seen at follow-up).

Analysis 14.3. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 3 Usual ITN use in peak season.

Analysis 14.4. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 4 Slept under a net the night before the survey.

Analysis 14.5. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 5 Malaria positive (total).

Analysis 14.6. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 6 Malaria positive (children under 15).

Analysis 14.7. Comparison 14 Free ITN vs. Microfinancing for nets, Outcome 7 Anaemia (Hb< 11g/dL).

Comparison 15. Malaria education vs. Diarrhea education

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Owns at least one ITN	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 Children under 5 sleeping under ITN	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 15.1. Comparison 15 Malaria education vs. Diarrhea education, Outcome 1 Owns at least one ITN.

Analysis 15.2. Comparison 15 Malaria education vs. Diarrhea education, Outcome 2 Children under 5 sleeping under ITN.

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
De La Cruz 2009	15/213	8/268		0%	2.36[1.02,5.46]
Favours control 0.01 0.1 1 10 100 Favours intervention					

Comparison 16. Educating Heads of Households in proper ITN use

Outcome or subgroup title	No. of studies	No. of partici- pants	Statistical method	Effect size
1 ITN utilization by under-five children at 6 months follow up	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2 ITN utilization by under-five children at 12 months	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3 Had fever in last 2 weeks (self reported at 6 months)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4 Had fever in last 2 weeks (self reported at 12 months)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 16.1. Comparison 16 Educating Heads of Households in proper ITN use, Outcome 1 ITN utilization by under-five children at 6 months follow up.

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Deribew 2012	1536/1679	978/1284		0%	1.2[1.16,1.24]
Favours control 0.01 0.1 1 10 100 Favours intervention					

Analysis 16.2. Comparison 16 Educating Heads of Households in proper ITN use, Outcome 2 ITN utilization by under-five children at 12 months.

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Deribew 2012	1195/1224	624/1020		0%	1.6[1.52,1.68]
Favours control 0.01 0.1 1 10 100 Favours intervention					

Analysis 16.3. Comparison 16 Educating Heads of Households in proper ITN use, Outcome 3 Had fever in last 2 weeks (self reported at 6 months).

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Deribew 2012	534/7939	1590/6764	+	0%	0.29[0.26,0.31]

Analysis 16.4. Comparison 16 Educating Heads of Households in proper ITN use, Outcome 4 Had fever in last 2 weeks (self reported at 12 months).

Study or subgroup	Experimental n/N	Control n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Deribew 2012	165/6909	858/6856	+	0%	0.19[0.16,0.22]

Comparison 17. CHW-provided intervention vs. control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Any ITN use in house (at follow up)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITN use among children <5 (at follow-up)	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 17.1. Comparison 17 CHW-provided intervention vs. control, Outcome 1 Any ITN use in house (at follow up).

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Keating 2012	0	0	0.7 (0.216)	+	0%	2.06[1.35,3.14]

Analysis 17.2. Comparison 17 CHW-provided intervention vs. control, Outcome 2 ITN use among children <5 (at follow-up).

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Keating 2012	0	0	0.8 (0.218)	+	0%	2.24[1.46,3.44]

Comparison 18. Education provided to nursing mothers vs. control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Prevalence of ITN use (ever use ITN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

Analysis 18.1. Comparison 18 Education provided to nursing mothers vs. control, Outcome 1 Prevalence of ITN use (ever use ITN).

Study or subgroup	Education n/N	Control n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Amoran 2012	138/190	57/180		0%	2.29[1.82,2.89]
Favours control				Favours education	

Comparison 19. Free ITN + undisclosed incentive for use vs. free ITN alone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 ITN ownership	1		Risk Ratio (Random, 95% CI)	Subtotals only
1.1 Follow-up at one month	1	519	Risk Ratio (Random, 95% CI)	1.0 [0.99, 1.01]
1.2 Follow-up at 6 month	1	519	Risk Ratio (Random, 95% CI)	0.99 [0.97, 1.01]
2 ITN use (Net mounted)	1		Risk Ratio (Random, 95% CI)	Subtotals only
2.1 Follow up at one month	1	519	Risk Ratio (Random, 95% CI)	1.10 [0.94, 1.28]
2.2 Follow-up at 6 months	1	519	Risk Ratio (Random, 95% CI)	1.00 [0.95, 1.07]

Analysis 19.1. Comparison 19 Free ITN + undisclosed incentive for use vs. free ITN alone, Outcome 1 ITN ownership.

Study or subgroup	Experimental N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
19.1.1 Follow-up at one month						
Krezanoski 2010	213	306	0 (0.005)		100%	1[0.99,1.01]
Subtotal (95% CI)					100%	1[0.99,1.01]
Heterogeneity: Not applicable Test for overall effect: Not applicable						
19.1.2 Follow-up at 6 month						
Krezanoski 2010	213	306	-0 (0.01)		100%	0.99[0.97,1.01]
Subtotal (95% CI)					100%	0.99[0.97,1.01]
Heterogeneity: Not applicable						
Favours control					Favours experimental	

Study or subgroup	Experi- mental N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
Test for overall effect: $Z=1.3(P=0.19)$						
Test for subgroup differences: $\text{Chi}^2=1.35$, $\text{df}=1$ ($P=0.25$), $I^2=25.7\%$						
Favours control				1	Favours experimental	

Analysis 19.2. Comparison 19 Free ITN + undisclosed incentive for use vs. free ITN alone, Outcome 2 ITN use (Net mounted).

Study or subgroup	Experi- mental N	Control N	log[Risk Ratio] (SE)	Risk Ratio IV, Random, 95% CI	Weight	Risk Ratio IV, Random, 95% CI
19.2.1 Follow up at one month						
Krezanoski 2010	213	306	0.1 (0.077)		100%	1.1[0.94,1.28]
Subtotal (95% CI)					100%	1.1[0.94,1.28]
Heterogeneity: Not applicable						
Test for overall effect: $Z=1.22(P=0.22)$						
19.2.2 Follow-up at 6 months						
Krezanoski 2010	213	306	0 (0.031)		100%	1[0.95,1.07]
Subtotal (95% CI)					100%	1[0.95,1.07]
Heterogeneity: Not applicable						
Test for overall effect: $Z=0.14(P=0.89)$						
Test for subgroup differences: $\text{Chi}^2=1.17$, $\text{df}=1$ ($P=0.28$), $I^2=14.42\%$						
Favours control				0.5 0.7 1 1.5 2	Favours experimental	

Comparison 20. Health framing vs. No framing marketing message

Outcome or subgroup title	No. of studies	No. of parti- pants	Statistical method	Effect size
1 Ownership (purchased experimental net)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITN use (net seen hanging after two months, if purchased)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN used by children	1		Odds Ratio (Random, 95% CI)	Subtotals only
4 ITN used by heads	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 20.1. Comparison 20 Health framing vs. No framing marketing message, Outcome 1 Ownership (purchased experimental net).

Study or subgroup	Health framing N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.2 (0.142)		0%	1.18[0.9,1.56]

Analysis 20.2. Comparison 20 Health framing vs. No framing marketing message, Outcome 2 ITN use (net seen hanging after two months, if purchased).

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0 (0.237)		0%	1.02[0.64,1.62]

Analysis 20.3. Comparison 20 Health framing vs. No framing marketing message, Outcome 3 ITN used by children.

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0 (0.244)		0%	1.01[0.63,1.63]

Analysis 20.4. Comparison 20 Health framing vs. No framing marketing message, Outcome 4 ITN used by heads.

Study or subgroup	Experimental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.1 (0.236)		0%	1.06[0.67,1.69]

Comparison 21. Financial framing vs. No framing marketing message

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased experimental net)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITN use (net seen hanging after two months, if purchased)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN used by children	1		Odds Ratio (Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4 ITN use by heads	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 21.1. Comparison 21 Financial framing vs. No framing marketing message, Outcome 1 Ownership (purchased experimental net).

Study or subgroup	Financial framing N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0 (0.143)		0%	1.03[0.78,1.36]
Favours control 0.01 0.1 1 10 100 Favours financial framing						

Analysis 21.2. Comparison 21 Financial framing vs. No framing marketing message, Outcome 2 ITN use (net seen hanging after two months, if purchased).

Study or subgroup	Financial framing N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.1 (0.243)		0%	0.92[0.57,1.47]
Favours control 0.01 0.1 1 10 100 Favours financial framing						

Analysis 21.3. Comparison 21 Financial framing vs. No framing marketing message, Outcome 3 ITN used by children.

Study or subgroup	Financial framing N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.1 (0.252)		0%	0.94[0.57,1.54]
Favours control 0.01 0.1 1 10 100 Favours financial framing						

Analysis 21.4. Comparison 21 Financial framing vs. No framing marketing message, Outcome 4 ITN use by heads.

Study or subgroup	Financial framing N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.2 (0.246)		0%	0.83[0.52,1.35]
Favours control 0.01 0.1 1 10 100 Favours financial framing						

Comparison 22. Voucher given to female head vs. voucher given to both heads jointly

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (measured by purchased experimental net)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITN use (net seen hanging after 2 months, if purchased)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN used by children	1		Odds Ratio (Random, 95% CI)	Subtotals only
4 ITN used by heads	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 22.1. Comparison 22 Voucher given to female head vs. voucher given to both heads jointly, Outcome 1 Ownership (measured by purchased experimental net).

Study or subgroup	Female head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.3 (0.141)		0%	0.73[0.56,0.97]
Favours both heads 0.01 0.1 1 10 100 Favours female head						

Analysis 22.2. Comparison 22 Voucher given to female head vs. voucher given to both heads jointly, Outcome 2 ITN use (net seen hanging after 2 months, if purchased).

Study or subgroup	female head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.3 (0.237)		0%	1.4[0.88,2.23]
Favours both heads 0.01 0.1 1 10 100 Favours female head						

Analysis 22.3. Comparison 22 Voucher given to female head vs. voucher given to both heads jointly, Outcome 3 ITN used by children.

Study or subgroup	Experi-mental N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.2 (0.246)		0%	1.28[0.79,2.07]
Favours control 0.01 0.1 1 10 100 Favours experimental						

Analysis 22.4. Comparison 22 Voucher given to female head vs. voucher given to both heads jointly, Outcome 4 ITN used by heads.

Study or subgroup	female N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.1 (0.235)		0%	0.93[0.58,1.47]

Comparison 23. Voucher given to male head vs. voucher given to both heads jointly

Outcome or subgroup title	No. of studies	No. of parti- cants	Statistical method	Effect size
1 Ownership (purchased experimental net)	1		Odds Ratio (Random, 95% CI)	Subtotals only
2 ITN used (net seen hanging after 2 months, if purchased)	1		Odds Ratio (Random, 95% CI)	Subtotals only
3 ITN used by children	1		Odds Ratio (Random, 95% CI)	Subtotals only
4 ITN used by heads	1		Odds Ratio (Random, 95% CI)	Subtotals only

Analysis 23.1. Comparison 23 Voucher given to male head vs. voucher given to both heads jointly, Outcome 1 Ownership (purchased experimental net).

Study or subgroup	Male head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.3 (0.142)		0%	0.71[0.53,0.93]

Analysis 23.2. Comparison 23 Voucher given to male head vs. voucher given to both heads jointly, Outcome 2 ITN used (net seen hanging after 2 months, if purchased).

Study or subgroup	Male head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.1 (0.235)		0%	1.07[0.67,1.69]

Analysis 23.3. Comparison 23 Voucher given to male head vs. voucher given to both heads jointly, Outcome 3 ITN used by children.

Study or subgroup	Male head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	0.3 (0.246)		0%	1.35[0.83,2.18]
Favours both heads 0.01 0.1 1 10 100 Favours male head						

Analysis 23.4. Comparison 23 Voucher given to male head vs. voucher given to both heads jointly, Outcome 4 ITN used by heads.

Study or subgroup	Male head N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Dupas 2009	0	0	-0.3 (0.239)		0%	0.76[0.48,1.22]
Favours both heads 0.01 0.1 1 10 100 Favours male head						

Comparison 24. Verbal commitment to purchase ITN vs. no verbal commitment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Ownership (purchased experimental net)	1		Odds Ratio (M-H, Random, 95% CI)	Subtotals only
2 ITN used (net seen hanging after 2 months)	1		Odds Ratio (M-H, Random, 95% CI)	Subtotals only
3 ITN used by children	1		Odds Ratio (M-H, Random, 95% CI)	Subtotals only
4 ITN used by heads	1		Odds Ratio (M-H, Random, 95% CI)	Subtotals only

Analysis 24.1. Comparison 24 Verbal commitment to purchase ITN vs. no verbal commitment, Outcome 1 Ownership (purchased experimental net).

Study or subgroup	Commitment n/N	No Commitment n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Dupas 2009	239/643	225/646		0%	1.11[0.88,1.39]
Favours no commitment 0.01 0.1 1 10 100 Favours commitment					

Analysis 24.2. Comparison 24 Verbal commitment to purchase ITN vs. no verbal commitment, Outcome 2 ITN used (net seen hanging after 2 months).

Study or subgroup	Commitment n/N	No Com- mitment n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Dupas 2009	124/225	124/208		0%	0.83[0.57,1.22]
Favours no commitment			0.01 0.1 1 10 100	Favours commitment	

Analysis 24.3. Comparison 24 Verbal commitment to purchase ITN vs. no verbal commitment, Outcome 3 ITN used by children.

Study or subgroup	Commitment n/N	No Com- mitment n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Dupas 2009	74/225	77/208		0%	0.83[0.56,1.24]
Favours no commitment			0.01 0.1 1 10 100	Favours commitment	

Analysis 24.4. Comparison 24 Verbal commitment to purchase ITN vs. no verbal commitment, Outcome 4 ITN used by heads.

Study or subgroup	Commitment n/N	No Com- mitment n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Dupas 2009	88/225	89/208		0%	0.86[0.59,1.26]
Favours no commitment			0.01 0.1 1 10 100	Favours commitment	

ADDITIONAL TABLES

Table 1. Included studies mapped according to the logic model.

ITN delivery mechanisms Objective: Sustained delivery						Appropriate ITN use interventions Objective: Sustained use			
Study overview	Channel	Duration	Cost to User	Choice of type and time	Sector	Channel	Duration	Type of intervention	Sector
AMORAN 2012¹	--	--	--	--	--	Community	Single (study campaign)	Education (provided to nursing mothers)	Civil society
COHEN 2010²	Routine Service (prenatal clinic)	Single (study campaign)	Free, Subsidized (90% to 100%)	No choice of ITN type; Time limited	Public (prenatal clinics)	--	--	--	--
DE LA CRUZ 2009³	--	--	--	--	--	Community (during bank meetings)	Single (study campaign)	Education	Civil society (NGO Freedom from Hunger (FFH))
DERIBEW 2012⁴	Unclear (ITNs provided by UNICEF but delivery channel unclear)	Single (study campaign)	Free	No choice of ITN type; Time limited	Unclear whether delivered by members of the study team or the trained village residents	Civil society (Community members received training of trainers then gave training to heads of households in the intervention villages)	Single (study campaign)	Education (tailored training of household heads)	Civil society
DUPAS 2009⁵	Community (voucher given during house-to-house visit); Formal retail (to obtain ITN)	Single (study campaign)	Free, Subsidized (40% to 100%)	No choice of ITN type; Time limited	Commercial (local retailers)	Community (house-to-house visit)	Single (study campaign)	Education (marketing messages)	Civil society (study personnel)

Table 1. Included studies mapped according to the logic model. (Continued)

FINK 2012 ⁶	Other (research project staff)	Single (study campaign)	Free, partially subsidized (50%) for loan group, and market price for controls	No choice of ITN type; Time unclear	Civil society (research project) and private (cotton company)	--	--	--	--
KEATING 2012 ⁷	Other (Universal ITN delivery in rural areas provided by National Malaria Control Center and PATH Malaria Control and Evaluation Partnership in Africa)	--	--	--	--	Community	Single (study campaign)	Education (community health workers)	Civil Society and public (PATH Malaria Control and Evaluation Partnership in Africa and the Zambian Ministry of Health)
KREZANOSKI 2010 ⁸	Community (voucher given during house-to-house visit); Other (ITNs distribution site set up in town)	Single (study campaign)	Free (coupons)	No choice of ITN type; Time limited	Civil society (NGO distribution site)	Other (ITNs study team site in the town)	Single (study campaign)	Education (printed ITN instructions)	Civil society (NGO Population Services International - PSI)
MULLER 2008 ⁹	Community	Unclear (possibly free ITNs in prenatal clinics and subsidized ITNs available in stores after the study campaign)	Free (prenatal clinics); subsidized (local retailers)	No choice of ITN type; Time - unclear (subsidized and free ITNs possibly available and after the study)	Public (prenatal clinics); Commercial (local retailers)	Community	Single (study campaign)	Education (Information, Education and Communication (IEC activities)); publicity (radio and television messages, poster exhibition, community-based information)	Civil society (NGO Population Services International - PSI)
TAROZZI 2011 ¹⁰	Community	Single (study campaign)	Free, Market price	Limited choice of ITN type (choice of size;	Civil society (NGO)	Community	Single (study campaign)	Education	Civil society (NGO Bharat Integrated Social

Table 1. Included studies mapped according to the logic model. (Continued)

	Time limited (choice of future re-treatment)	Welfare Agency - BISWA)
<p>1. Intervention: a one day educational program based on the national malaria control program provided to nursing mothers. Comparison: households selected from a different town receiving no intervention.</p> <p>2. 20 prenatal clinics were assigned to different subsidy levels: (5 clinics - ITNs free of charge; 5 clinics - KES 10 (97.5% subsidized); 5 clinics - KES 20 (95.0% subsidy); 3 clinics - KES 40 (90% subsidy); 5 clinics = control + lottery on announced random day for additional discount</p> <p>3. Intervention: Malaria education Comparison: 1. Attention placebo of diarrhea education; 2. No education</p> <p>4. Intervention: Training of heads of households (education with posters, manuals and demonstrations on appropriate long-lasting (LL) ITN use); Free LLITN; Monthly monitoring of appropriate use and malaria occurrence with appropriate LLITN use training; Three times a year mass blood examination for anemia and malaria of children under five and pregnant women Comparison: Free LLITN; Monthly monitoring of malaria occurrence; Three times a year mass blood examination for anemia and malaria of children under five and pregnant women</p> <p>5. Intervention: Households were assigned to 1. A subsidy level (40% to 100%); 2. One of three “marketing” groups (“health framing”, “financial framing” and no marketing message); 3. One of two “commitment” groups (verbal commitment; no verbal commitment to buy LLITN); 4. One of three “targeting” groups (voucher given to female head of the household, male head or both heads) Single-headed households were excluded. Comparison: Intervention groups were compared</p> <p>6. Intervention: In the free group, households could receive one ITN for each sleeping space. In the loan group, households could get ITNs at 50% subsidized cost with repayment due at the end of the harvesting season. The maximum number of ITNs each household could receive was restricted to the number of sleeping spaces in the household. Comparison: ITNs for sale at market price.</p> <p>7. Intervention: Community-based interpersonal communication intervention delivered through community health workers (CHWs). CHWs provided information about malaria transmission, prevention, and ITNs. Comparison: CHWs provided an HIV awareness campaign to their communities.</p> <p>8. Intervention: Voucher for an ITN and undisclosed “prize” promised for appropriate use; Comparison: Voucher for an ITN; no incentive promised Note: ITNs came with instructions in the local language explaining how to mount the bednet over a bed</p> <p>9. Intervention 1: Access to subsidized ITNs + free ITNs available to pregnant women through prenatal clinics + social marketing;Intervention 2: Access to subsidized ITNs + social marketing</p> <p>10. Intervention: 1. Microlender BISWA offered contracts for the purchase of ITNs and re-treatments (ITN price was not subsidized); + brief information campaign on malaria and bednets 2. Free ITNs + brief information campaign on malaria and bednets Comparison: No ITN distribution program or education on malaria and bednets</p>		

APPENDICES

Appendix 1. Search Strategies

Strategies are ordered as follows: Medline, Pubmed, Cochrane, CINAHL, Dissertations & Theses, EMBASE, ISI Web of Knowledge, LILACS. Any strategies not found here are in Grey Literature Searching.

Medline

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1948 to Present>

Search Date: February 12, 2013

- 1 Plasmodium.ti,ab. (32671)
- 2 exp malaria/ (46667)
- 3 Plasmodium/ or Plasmodium falciparum/ or Plasmodium malariae/ or Plasmodium ovale/ or Plasmodium vivax/ [related to malaria] (29445)
- 4 culicidae/ or exp anopheles/ [Mosquitos] (17830)
- 5 (culicidae or anopheles).ti,ab. (11769)
- 6 malaria\$.ti,ab. (53189)
- 7 mosquito\$.ti,ab. (24848)
- 8 (marsh fever or blackwater fever or paludism?).ti,ab. [synonyms for malaria] (186)
- 9 Mosquito Control/ (6016)
- 10 or/1-9 [Malaria/Mosquitos] (95623)
- 11 Insecticide-Treated Bednets/ or Mosquito Nets/ (404)
- 12 (net? or netting or bednet\$ or "bed net\$" or ITN? or LLIN?).ti,ab. (73154)
- 13 (bed\$ adj2 screen\$).ti,ab. (154)
- 14 curtain?.ti,ab. (907)
- 15 or/11-14 [Nets] (74216)
- 16 10 and 15 [Malaria/Mosquito Control & Nets] (2458)
- 17 limit 16 to ed="20120316-20130211" (235)
- 18 16 and ("20120316" or 201204\$ or 201205\$ or 201206\$ or 201207\$ or 201208\$ or 201209\$ or 201210\$ or 201211\$ or 201212\$ or 2013\$).ep,dc. (224)
- 19 17 or 18 [results limited to 16 March 2012-11 February 2013] (322)
- 20 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti. (815774)
- 21 exp animals/ not humans.sh. (3754079)
- 22 20 not 21 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing] (753407)
- 23 intervention?.ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali? e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib\$ or prescription? or primary care or professional\$ or provider? or regulatory or regulatory or tailor\$ or target \$ or team\$ or usual care)).ab. (136244)
- 24 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (8070)
- 25 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (666497)
- 26 demonstration project?.ti,ab. (1798)
- 27 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (56308)
- 28 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (519)
- 29 trial.ti. or ((study adj3 aim?) or "our study").ab. (535009)
- 30 (before adj10 (after or during)).ti,ab. (326709)
- 31 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. (91261)
- 32 ("time series" adj2 interrupt\$).ti,ab,hw. (791)
- 33 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (7472)
- 34 pilot.ti. (34335)
- 35 Pilot projects/ (74038)
- 36 (clinical trial or controlled clinical trial or multicenter study).pt. (589334)
- 37 (multicentre or multicenter or multi-centre or multi-center).ti. (25359)
- 38 random\$.ti,ab. or controlled.ti. (667824)

Strategies to increase the ownership and use of insecticide-treated bednets to prevent malaria (Review)

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39 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. (364124)
40 evaluation studies as topic/ or prospective studies/ or retrospective studies/ [Added Jan 2013] (864141)
41 (utili?ation or programme or programmes).ti. [Added Jan 2013] (50335)
42 (during adj5 period).ti,ab. [Added Jan 2013] (275421)
43 ((strategy or strategies) adj2 (improv\$ or education\$)).ti,ab. [Added Jan 2013] (15308)
44 "comment on".cm. or review.pt. or (review not "peer review\$").ti. or randomized controlled trial.pt. [Changed Jan 2013] (2671398)
45 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (1273864)
46 exp animals/ not humans.sh. (3754079)
47 (or/23-43) not (or/44-46) [EPOC Methods Filter 2.5-added Evaluation Studies line forward-- Jan 20130 Medline] (2540641)
48 19 and 22 [RCT Results] (44)
49 (19 and 47) not 48 [EPOC Results] (95)
50 19 not (48 or 49) [Results without Filters] (183)

Pubmed

Search date: February 13, 2013

Search	Query	Items found
#11	(#9 AND #10)	63
#10	((("2012/03/16"[Date - Publication] : "3000"[Date - Publication])) OR ("2012/03/16"[Date - Create] : "3000"[Date - Create])) OR ("2012/03/16"[Date - Entrez] : "3000"[Date - Entrez])	1012431
#9	(#5 AND #8)	398
#8	(#6 or #7)	785
#7	(((((net[Title]) OR nets[Title]) OR netting[Title]) OR bednet*[Title]) OR "bed net*[Title]) OR ITN[Title]) OR ITNs[Title]) OR LLIN[Title]) OR LLINs[Title]) OR bed* screen[Title]) OR curtain[Title]) OR curtains[Title])	384
#6	((("Insecticide-Treated Bednets"[Mesh]) OR "Mosquito Nets"[Mesh])	402
#5	(#1 OR #2 OR #3 OR #4)	80881
#4	"Mosquito Control"[Mesh]	6008
#3	("Plasmodium"[Mesh] OR "Plasmodium ovale"[Mesh] OR "Plasmodium falciparum"[Mesh] OR "Plasmodium vivax"[Mesh] OR "Plasmodium malariae"[Mesh])	33822
#2	("Malaria"[Mesh] OR "Malaria, Vivax"[Mesh] OR "Malaria, Cerebral"[Mesh] OR "Malaria, Falciparum"[Mesh] OR "Blackwater Fever"[Mesh] OR "Malaria, Avian"[Mesh])	47034
#1	(((((plasmodium[Title]) OR culicidae[Title]) OR anopheles[Title]) OR malaria*[Title]) OR mosquito*[Title]) OR marsh fever[Title]) OR blackwater fever[Title]) OR paludism*[Title])	66208

Cumulative Index to Nursing and Allied Health Literature (CINAHL)

Search date: February 12, 2013

#	Query	Results
S60	S24 NOT (S57 OR S58)	5

(Continued)

Published Date from: 20120301-20130231

S59	S57 NOT S58	3
	Published Date from: 20120301-20130231	
S58	S24 AND S56	1
	Published Date from: 20120301-20130231	
S57	S24 AND S49	35
S56	S50 or S51 or S52 or S53 or S54 or S55	131,882
S55	TI ("control* N1 clinical" or "control* N1 group*" or "control* N1 trial*" or "control* N1 study" or "control* N1 studies" or "control* N1 design*" or "control* N1 method*") or AB ("control* N1 clinical" or "control* N1 group*" or "control* N1 trial*" or "control* N1 study" or "control* N1 studies" or "control* N1 design*" or "control* N1 method*")	1
S54	TI controlled or AB controlled	57,161
S53	TI random* or AB random*	99,038
S52	TI ("clinical study" or "clinical studies") or AB ("clinical study" or "clinical studies")	6,380
S51	(MM "Clinical Trials+")	7,645
S50	TI ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*)) or AB ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*))	7,208
S49	S25 or S26 or S27 or S28 or S29 or S30 or S31 or S32 or S33 or S34 or S35 or S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48	385,783
S48	TI ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 "more than")) or AB ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 "more than"))	1,380
S47	TI ((control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study)) or AB ((control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study))	41,912
S46	TI (multicentre or multicenter or multi-centre or multi-center) or AB random*	89,736
S45	TI random* OR controlled	30,734
S44	TI (trial or (study n3 aim) or "our study") or AB ((study n3 aim) or "our study")	75,001

(Continued)

S43	TI (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop)) or AB (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop))	288
S42	TI (demonstration project OR demonstration projects OR preimplement* or pre-implement* or post-implement* or postimplement*) or AB (demonstration project OR demonstration projects OR preimplement* or pre-implement* or post-implement* or postimplement*)	1,204
S41	(intervention n6 clinician*) or (intervention n6 community) or (intervention n6 complex) or (intervention n6 design*) or (intervention n6 doctor*) or (intervention n6 educational) or (intervention n6 family doctor*) or (intervention n6 family physician*) or (intervention n6 family practitioner*) or (intervention n6 financial) or (intervention n6 GP) or (intervention n6 general practice*) Or (intervention n6 hospital*) or (intervention n6 impact*) Or (intervention n6 improv*) or (intervention n6 individualize*) Or (intervention n6 individualise*) or (intervention n6 individualizing) or (intervention n6 individualising) or (intervention n6 interdisciplin*) or (intervention n6 multicomponent) or (intervention n6 multi-component) or (intervention n6 multidisciplin*) or (intervention n6 multi-disciplin*) or (intervention n6 multifacet*) or (intervention n6 multi-facet*) or (intervention n6 multi-modal*) or (intervention n6 multi-modal*) or (intervention n6 personalize*) or (intervention n6 personalise*) or (intervention n6 personalizing) or (intervention n6 personalising) or (intervention n6 pharmaci*) or (intervention n6 pharmacist*) or (intervention n6 pharmacy) or (intervention n6 physician*) or (intervention n6 practitioner*) Or (intervention n6 prescrib*) or (intervention n6 prescription*) or (intervention n6 primary care) or (intervention n6 professional*) or (intervention* n6 provider*) or (intervention* n6 regulatory) or (intervention n6 regulatory) or (intervention n6 tailor*) or (intervention n6 target*) or (intervention n6 team*) or (intervention n6 usual care)	37,312
S40	TI (collaborativ* or collaboration* or tailored or personalised or personalized) or AB (collaborativ* or collaboration* or tailored or personalised or personalized)	34,400
S39	TI pilot	10,533
S38	(MH "Pilot Studies")	27,211
S37	AB "before-and-after"	15,550
S36	AB time series	1,607
S35	TI time series	225
S34	AB (before* n10 during or before n10 after) or AU (before* n10 during or before n10 after)	29,454
S33	TI ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*)) or AB ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*))	44,817
S32	TI ((quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design*)) or AB ((quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design*))	11,077

(Continued)

	perimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design*))	
S31	TI pre w7 post or AB pre w7 post	8,147
S30	MH "Multiple Time Series" or MH "Time Series"	1,230
S29	TI ((comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies) or AB ((comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies)	9,582
S28	MH Experimental Studies or Community Trials or Community Trials or Pretest-Posttest Design + or Quasi-Experimental Studies + Pilot Studies or Policy Studies + Multicenter Studies	31,392
S27	TI (pre-test* or pretest* or posttest* or post-test*) or AB (pre-test* or pretest* or posttest* or "post test*") OR TI (preimplement*" or pre-implement*) or AB (pre-implement* or preimplement*)	6,247
S26	TI (intervention* or multiintervention* or multi-intervention* or postintervention* or post-intervention* or preintervention* or pre-intervention*) or AB (intervention* or multiintervention* or multi-intervention* or postintervention* or post-intervention* or preintervention* or pre-intervention*)	133,749
S25	(MH "Quasi-Experimental Studies")	5,367
S24	S22 and S23	103
S23	S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21	625
S22	S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13	4,086
S21	AB curtain?	36
S20	TI curtain?	41
S19	AB (bed* N2 screen*)	44
S18	TI (bed* N2 screen*)	18
S17	AB (net? OR netting OR bednet* OR "bed net*" OR ITN? OR LLIN?)	292
S16	TI (net? OR netting OR bednet* OR "bed net*" OR ITN? OR LLIN?)	255
S15	AB ("insecticide-treated bednets" OR "mosquito nets")	27
S14	TI ("insecticide-treated bednets" OR "mosquito nets")	25
S13	AB "mosquito control"	23
S12	TI "mosquito control"	12
S11	AB (marsh fever OR blackwater fever OR paludism?)	0
S10	TI (marsh fever OR blackwater fever OR paludism?)	0
S9	AB mosquito*	376

(Continued)

S8	TI mosquito*	183
S7	AB malaria*	1,448
S6	TI malaria*	1,873
S5	AB (culicidae OR anopheles)	55
S4	TI (culicidae OR anopheles)	10
S3	AB Plasmodium	490
S2	TI Plasmodium	307
S1	MH malaria	3,199

Cochrane Library; CENTRAL, CDSR, DARE, NHS EED, HTA, MTH (WILEY)

Search date: February 12, 2013

ID Search Hits

- #1 MeSH descriptor: [Malaria] explode all trees 1849
- #2 MeSH descriptor: [Plasmodium] this term only 16
- #3 MeSH descriptor: [Plasmodium falciparum] explode all trees 629
- #4 MeSH descriptor: [Plasmodium malariae] explode all trees 14
- #5 MeSH descriptor: [Plasmodium ovale] explode all trees 0
- #6 MeSH descriptor: [Plasmodium vivax] explode all trees 66
- #7 malaria*:ti,ab,kw 2784
- #8 (net or nets or netting or bednet* or ITN or LLIN):ti,ab,kw or (bed* near/2 screen*):ti,ab,kw 3126
- #9 MeSH descriptor: [Mosquito Nets] explode all trees 26
- #10 MeSH descriptor: [Culicidae] explode all trees 130
- #11 MeSH descriptor: [Anopheles] explode all trees 74
- #12 (culicidae or anopheles or plasmodium or malaria*):ti OR (culicidae or anopheles or plasmodium or malaria*):ab 2728
- #13 ("marsh fever" or "blackwater fever" or paludism):ti,ab 2
- #14 mosquito*:ti,ab 266
- #15 MeSH descriptor: [Mosquito Control] this term only 127
- #16 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #10 or #11 or #12 or #13 or #14 or #15 2906
- #17 MeSH descriptor: [Insecticide-Treated Bednets] this term only 21
- #18 (curtain):ti,ab 40
- #19 #8 or #9 or #17 or #18 3151
- #20 #16 and #19 from 2012 to 2013 4

Dissertations and Theses (ProQuest)

Search date: 26/05/2011

Strategy 1

ABS((malaria* or malariae* or plasmodium* or anophele* or culicidae* or mosquito*)) AND ABS((use or usage or uses or own or ownership or possession? or purchase? or obtain* or implement* or cost? or deliver* or afford* or campaign* or program or utiliz* or subsid*) W/5 ("malaria net*" or bednet* or "bed net*" or net or nets or netting or curtain* or "bed screen" or "insecticide-treated")) Results :42

Strategy 2

ABS((malaria* or malariae* or plasmodium* or anophele* or culicidae* or mosquito*) AND ("malaria net*" or bednet* or "bed net*" or net or nets or netting or curtain* or "bed screen" or "insecticide-treated") AND (random* OR controlled OR trial OR "before and after" OR "clinical" OR "time interrupted")) Results: 52

EMBASE

Classic+EMBASE <1947 to 2013 Feb 12>

Search date: February 12, 2013

1 (Plasmodium adj2 (falciparum or malar\$ or ovale or vivax)).ti,ab. [A genus of protozoa that comprise the malaria parasites of mammals. Four species infect humans P FALCIPARUM; P MALARIAE; P OVALE, and P VIVAX] (29739)

2 plasmodium/ or plasmodium falciparum/ or plasmodium malariae/ or plasmodium ovale/ or plasmodium vivax/ (41827)

3 malaria/ or malaria falciparum/ or plasmodium malariae infection/ or plasmodium ovale malaria/ or plasmodium vivax malaria/ (70853)

4 exp Anopheles/ [A genus of mosquitoes (CULICIDAE that are known vectors of MALARIA] (12211)

5 (culicidae or anopheles).ti,ab. (14369)

6 malaria\$.ti,ab. (69563)

7 (marsh fever or blackwater fever or paludism?).ti,ab. (497)

8 mosquito/ (20396)

9 mosquito\$.ti,ab. (31298)

10 malaria control/ (5378)

11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 (127233)

12 exp bed net/ (2080)

13 ("insecticide-treated bednet\$" or "mosquito bednet\$" or net? or netting or bednet\$ or "bed net\$" or ITN? or LLIN?).ti,ab. (91327)

14 (bed\$ adj2 screen\$).ti,ab. (221)

15 curtain?.ti,ab. (1268)

16 12 or 13 or 14 or 15 (93297)

17 11 and 16 (3705)

18 ("20120316" or 201204\$ or 201205\$ or 201206\$ or 201207\$ or 201208\$ or 201209\$ or 201210\$ or 201211\$ or 201212\$ or 2013\$).dp,em,yr. (385404)

19 17 and 18 [Results limited to 16 Mar 2012 to 11 Feb 2013] (124)

20 controlled clinical trial/ or controlled study/ or randomized controlled trial/ [EM] (4043298)

21 randomi?ed.ti. or ((random\$ or control) adj3 (group? or cohort? or patient? or hospital\$ or department?)).ab. or (controlled adj2 (study or trial)).ti. (642855)

22 (random sampl\$ or random digit\$ or random effect\$ or random survey or random regression).ti,ab. not randomized controlled trial/ [Per BMJ Clinical Evidence filter] (48814)

- 23 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) and (human/ or normal human/ or human cell/) (14407185)
- 24 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) not 23 (5753258)
- 25 (or/20-21) not (or/22,24) [RCT Filter for EMBASE] (2743263)
- 26 intervention?.ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali? e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib\$ or prescription? or primary care or professional\$ or provider? or regulatory or regulatory or tailor\$ or target \$ or team\$ or usual care)).ab. (181046)
- 27 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (10722)
- 28 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (1489366)
- 29 demonstration project?.ti,ab. (2252)
- 30 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (83455)
- 31 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (710)
- 32 trial.ti. or ((study adj3 aim?) or "our study").ab. (751809)
- 33 (before adj10 (after or during)).ti,ab. (447276)
- 34 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (10336)
- 35 pilot.ti. or (pilot adj (project? or study or trial)).ab. (80137)
- 36 (multicentre or multicenter or multi-centre or multi-center).ti. (35560)
- 37 random\$.ti,ab. or controlled.ti. (860965)
- 38 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. (568557)
- 39 ((evaluation or prospective or retrospective) adj study).ti,ab. [Added Jan 2013] (214628)
- 40 (utili?ation or programme or programmes).ti. [Added Jan 2013] (67640)
- 41 (during adj5 period).ti,ab. [Added Jan 2013] (385428)
- 42 ((strategy or strategies) adj2 (improv\$ or education\$)).ti,ab. [Added Jan 2013] (19474)
- 43 *experimental design/ or *pilot study/ or quasi experimental study/ (5800)
- 44 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab. (121683)
- 45 ("time series" adj2 interrupt\$).ti,ab. (953)
- 46 or/26-45 (4165910)
- 47 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (1607477)
- 48 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) and (human/ or normal human/ or human cell/) (14407185)
- 49 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) not 48 (5753258)

50 46 not (or/47,49) [EPOC Filter 2.5--Added Lines Jan. 2013] (3567983)

51 19 and 25 [RCT Results] (21)

52 (19 and 50) not 51 [EPOC Results] (38)

53 19 not (51 or 52) (65)

Healthstar

<1999 to February 2013>

Search date: February 12, 2013

1 exp Malaria/ (11086)

2 Plasmodium.ti,ab. (4548)

3 plasmodium/ or plasmodium falciparum/ or plasmodium malariae/ or plasmodium ovale/ or plasmodium vivax/ (4123)

4 culicidae/ or exp anopheles/ (2439)

5 (culicidae or anopheles).ti,ab. (1319)

6 malaria\$.ti,ab. (11868)

7 mosquito\$.ti,ab. (3398)

8 (marsh fever or blackwater fever or paludism?).ti,ab. (25)

9 Mosquito Control/ (1581)

10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 (16039)

11 ("insecticide-treated bednet*" or "mosquito net*" or net? or netting or bednet\$ or "bed net\$" or ITN? or LLIN?).ti,ab. (14932)

12 (bed\$ adj2 screen\$).ti,ab. (68)

13 curtain?.ti,ab. (292)

14 11 or 12 or 13 [nets] (15268)

15 10 and 14 [malaria/mosquito control & Nets] (1043)

16 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti. (295573)

17 exp animals/ not humans.sh. (12274)

18 16 not 17 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing] (295264)

19 intervention?.ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali? e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib\$ or prescription? or primary care or professional\$ or provider? or regulatory or regulatory or tailor\$ or target \$ or team\$ or usual care)).ab. (65884)

20 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (285015)

21 demonstration project?.ti,ab. (744)

22 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (20971)

23 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (243)

24 trial.ti. or ((study adj3 aim?) or "our study").ab. (202059)

25 (before adj10 (after or during)).ti,ab. (88535)

26 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. [ML] (20297)

27 ("time series" adj2 interrupt\$).ti,ab,hw. [ML] (427)

28 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (2320)

29 pilot.ti. (14679)

30 Pilot projects/ [ML] (35435)

31 (clinical trial or controlled clinical trial or multicenter study).pt. [ML] (269393)

32 (multicentre or multicenter or multi-centre or multi-center).ti. (11722)

33 random\$.ti,ab. or controlled.ti. (257626)

34 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML] (80000)

35 "comment on".cm. or review.ti.pt. or randomized controlled trial.pt. [ML] (928035)

36 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (22455)

37 exp animals/ not humans.sh. [ML] (12274)

38 *experimental design/ or *pilot study/ or quasi experimental study/ [EM] (8220)

39 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab. [EM] (20297)
40 ("time series" adj2 interrupt\$).ti,ab. [EM] (427)
41 (or/19-34) not (or/35-37) [EPOC Methods Filter ML 1.9] (720712)
42 or/19-25,28-29,32-33,36,38-40 [EPOC Methods Filter EM 1.9-2.3] (815906)
43 15 and 18 [Malaria/Mosquito control & Nets & RCT] (165)
44 (15 and 42) not 43 [Malaria/Mosquito control & Nets & unique EPOC] (204)

ISI Web of Knowledge

Search Date: February 12, 2013

# 4	830	#1 OR #2 Refined by: [excluding] Subject Areas=(PARASITOLOGY OR ENTOMOLOGY OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR BIOCHEMICAL RESEARCH METHODS OR PLANT SCIENCES OR CHEMISTRY, ANALYTICAL OR VETERINARY SCIENCES OR VIROLOGY OR EVOLUTIONARY BIOLOGY OR MICROBIOLOGY OR GENETICS & HEREDITY OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR CHEMISTRY, MEDICINAL) <i>Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years</i>
# 3	1,414	#1 OR #2 <i>Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years</i>
# 2	1,414	TS=(malaria* OR plasmodium falciparum OR plasmodium malariae OR plasmodium ovale OR plasmodium vivax OR mosquito* OR anopheles OR culicidae) AND TS=(bednet* OR bed net* OR curtain* OR bedding) <i>Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years</i>
# 1	287	TI=(malaria* OR plasmodium falciparum OR plasmodium malariae OR plasmodium ovale OR plasmodium vivax OR mosquito* OR anopheles OR culicidae) AND TI=(bednet* OR bed net* OR curtain* OR bedding) <i>Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years</i>

Latin American and Caribbean Health Sciences Database (LILACS)

Search Date: February 12, 2013

Search on : "MALARIA" or "MALARIA CEREBRAL" or "MALARIA CEREBRAL/" or "MALARIA FALCIPARUM" or "MALARIA FALCIPARUM/" or "MALARIA POR PLASMODIUM VIVAX" or "MALARIA POR PLASMODIUM VIVAX/" or "MALARIA VIVAX" or "MALARIA VIVAX/" or "PLASMODIUM" or "PLASMODIUM FALCIPARUM" or "PLASMODIUM FALCIPARUM/" or "PLASMODIUM MALARIAE" or "PLASMODIUM MALARIAE/" or "PLASMODIUM VIVAX" or "PLASMODIUM VIVAX/" or "PLASMODIUM/" or "MOSQUITO" or "MOSQUITO." or "MOSQUITO/" or "MOSQUITOE" or "MOSQUITOES" or "MOSQUITOES/" or "MOSQUITOS" or "MOSQUITOS/" [Words] and "BEDNET" or "BEDNETS" or "NET" or "MOSQUITO-NETS" or "CURTAIN" or "CURTAINS" [Words] Results: 27

Appendix 2. Gray Literature Searching

Database/Web Site	Date [ddmmyy]	Search Terms	URL	Results
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(Continued)

3ie Database of Impact Evaluations	09/05/11	malaria	http://www.3ieim-pact.org/page.php?pg=search_impact&key-word=malaria+&x=13&y=4	
<i>AEGiS (AIDS Education Global Information System)</i>	26/05/11	malaria (search on publications page)	www.aegis.com/	28
African Index Medicus	05/05/11	Search on : "MALARIA" or "MALARIAE" or "PLASMODIUM" or "MOSQUITO" or "MOSQUITOES" [Key Word] and "BEDNETS" or "NET" or "NETTING" or "CURTAINS" or "BEDDING" [Key Word]	http://indexmedicus.afro.who.int/	25
<i>African Journals OnLine (AJOL)</i>	10/05/11	Search all categories for (malaria* OR plasmodium* OR moquito* OR anaphele* OR culicidae*) AND (bednet* OR net OR nets OR curtain* OR bedding*)	http://www.ajol.info/	58
<i>AFROLIB Database</i>	10/05/11	("MALARIA" or "PLASMODIUM" or "MOSQUITO") [Key Words] and "BEDNETS" or "BEDDING" or "NET" or "NETS" or "NETTING" [Key Words]	http://afrolib.afro.who.int/	13
<i>Alliance for Malaria Prevention</i>	26/05/11	scanned site; describes working groups and provides toolkits	http://www.allianceformalariaprevention.com/	0
<i>Bioline International</i>	10/05/11	Malaria AND net	http://www.bioline.org.br/	10
<i>British Library for Development Studies (BLDS)</i>	09/05/11	malaria [subject] AND (net* or bednet*)[title]	http://opendocs.ids.ac.uk/opendocs/handle/123456789/3	15
<i>Google Scholar</i>	26/05/11	STRATEGY 1: allintitle: malaria AND (bednet OR bednets OR net OR nets OR curtain OR curtains OR netting OR ITNs) AND (own OR ownership OR possession OR use OR usage OR uses OR cost OR afford OR delivery OR subsidy OR subsidize OR purchase OR price OR utilize OR utilization OR voucher OR vouchers OR campaign OR program OR programs OR distribution) STRATEGY 2: Search: allintitle: malaria AND (bednet OR bednets OR net OR nets OR curtain OR curtains OR netting OR ITNs) AND (random OR randomly OR randomized OR controlled OR trial OR intervention OR clinical OR "pre-post test" OR "time interrupted" OR "before and after" OR RCT OR CBA OR CCT OR ITS)	scholar.google.com	98
<i>IDEAS Economic and Finance database (RePEc)</i>	09/05/11	(malaria malariae plasmodium mosquito mosquito mosquitos mosquitoes anopheles culicidae) + (bednet bednets "bed net" "bed nets" curtain curtains netting net nets) Title/Abstract [vertical line= OR ; + = AND]	http://ideas.repec.org/	52
<i>IFRC (International Federation of Red Cross and</i>	26/05/11	Search: malaria on Publications page.	http://www.ifrc.org/en/what-we-do/health/publications/	1

(Continued)

Red Crescent Societies)

<i>IndMED (Indexing of Indian Medical Journals)</i>	10/05/11	(malaria:keyword or plasmodium:keyword or mosquito:keyword or anophele:keyword or culicidae:keyword) and (net:keyword or bednet:keyword or curtain:keyword or bedding:keyword)	http://indmed.nic.in/	9
<i>JOLIS library catalogue [catalogue for the World Bank and IMF]</i>	10/05/11	Keywords anywhere "(malaria* OR plasmodium* OR mosquito* OR anophele* OR culicidae*)" AND Keywords anywhere "(bednet* OR "bed net*" OR curtain* OR net OR nets OR netting OR bedding OR (bed ADJ screen))"	http://jolis.worldbankimflib.org/e-nljolis.htm	15
<i>Malaria in Pregnancy Library (Trials)</i>	03/05/11	Bednet* or bed net* all fields	http://www.update-software.com/publications/malaria/	6
<i>MedCarib</i>	10/05/11	"MALARIA" or "MALARIAE" or "PLASMODIUM" or "MOSQUITO" or "MOSQUITOES" or "CULICIDAE" [Words] and "NETS" or "NETTING" [Words]	http://bases.bireme.br/cgi-bin/wxislind.exe/iah/online/?IsisScript=iah/iah.xis&base=Med-Carib&lang=i&form=F	3
Medical Research Council of South Africa (web site): Malaria Reports section; was searched because SAMED database was not operational)	20/03/12	scanned list of research reports and publications	http://www.mrc.ac.za/malaria/reports.htm ; http://www.mrc.ac.za/malaria/publications_new.pdf	0
<i>New York Academy of Medicine Grey Literature Collection</i>	26/05/11	Search: Title: (malaria or malariae or plasmodium or mosquito or mosquitoes or mosquitos or anopheles or culicidae) AND (bednet or bednets or "bed net" or "bed nets" or net or nets or netting or nettings or curtain or curtains or "bed screen" or "bed screens")	http://www.nyam.org/library/online-resources/grey-literature-report/	7
<i>Open SIGLE</i>	26/05/11	Title: (malaria or malariae or mosquito or mosquitoes or mosquitos or plasmodium or anopheles or culicidae) AND (bednet or bednets or bed net or bed nets or net or nets or netting or nettings or curtain or curtains)	http://www.greynet.org/opensiglerepository.html	5
<i>PAHO</i>	26/05/11	Publication list from PAHO's malaria site	www.paho.org/malaria	24
<i>PAHO Library Catalogue</i>	10/05/11	words or phrase "(malaria* OR plasmodium OR mosquito* OR anophele* OR culicidae*)" AND words or phrase "(bednet* OR "bed net*" OR curtain* OR net OR nets OR netting OR bedding*)"	http://library.paho.org/uht-bin/cgisirsi.exe/mHjRIB-jNzP/109010005/60/50/X	14
<i>Rockefeller Foundation</i>	26/05/11	Search: malaria	http://www.rockefeller-foundation.org/	0

(Continued)

<i>Roll Back Malaria</i> – from PAHO Initiatives: Malaria	26/05/11	RBM Partnership publications (from webpage)	http://www.rbm.who.int/multimedia/index.html	34
The Abdul Latif Jameel Poverty Action Lab	09/05/11	(malaria*) AND ("bed net*") as keyword	http://www.povertyactionlab.org/	7
<i>UNICEF</i>	26/05/11	Full text search because field searching was not possible; used search box on homepage: malaria AND (bednet OR bednets OR "mosquito net" OR "insecticide treated net" OR curtain OR curtains) AND (use OR usage OR price OR cost OR afford OR subsidy OR subsidize OR subsidies OR voucher OR campaign OR program OR intervention OR delivery OR distribution OR uptake OR possession OR utilization) AND (random OR randomization OR randomly OR trial OR clinical OR controlled OR "interrupted time" OR "before and after" OR RCT OR CBA OR CCT)	http://www.unicef.org/index.php	112
<i>USAID</i>	26/05/11	allintitle: malaria AND (nets OR bednets OR bednet OR curtain OR curtains) -restricted to title because cannot limit to abstract	http://www.usaid.gov/[searched publications catalogue; unabel to access the catalogue on March 19th, 2012]	17
<i>WHO Global health Library</i>	10/05/11	Search Strategy: ("Plasmodium" OR "Plasmodium falciparum" OR "Plasmodium malariae" OR "Plasmodium ovale" OR "Plasmodium vivax" OR malaria* OR plasmodium OR mosquito*) AND (bednet* OR net OR nets OR curtain*) in Title	http://www.who.int/ghl/en/	630
<i>WHOLIS</i>	10/05/11	words or phrase "(malaria* OR plasmodium OR mosquito* OR anaphele* OR culicidae*)"	http://disei.who.int/uht-bin/cgisirsi/Mon+Mar+19+21:10:58+MET+2012/0/49 Note: (WHO publications from 1948 onwards and articles from WHO-produced journals and technical documents from 1986 to the present)	106
<i>WHO-Malaria Publications on insecticide-treated materials</i>	26/05/11	downloaded all malaria reports	www.who.int/malaria/publications/insecticide_treated_materials/en/index.html	25
<i>World Bank "Research"</i>	26/05/11	malaria and nets all fields using a search box on the web page	http://econ.worldbank.org/external/default/main?menuPK=469435&pagePK=64165236&piPK=64165141&theSitePK=469382	90

CONTRIBUTIONS OF AUTHORS

PT and VW conceived the idea for the systematic review. LAP and JP drafted and revised the systematic review with suggestions from EU, VW, ETG, JPP, PT, AA and MG who extensively reviewed the paper and provided feedback on the draft. GW was consulted for statistical advice. Data extraction and risk of bias assessment was conducted by LAP, EU, JP, ETG.

DECLARATIONS OF INTEREST

AA has published papers on malaria drug quality in Africa and India. MG has been engaged in studies potentially eligible for our Cochrane Review. LAP, EU, VW, JP, ETG, JPP, GW and PT have no known conflicts of interest.

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- Knowledge Synthesis Grant, CIHR, Canada.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

In the protocol, 'equity ratio of household ownership with ITNs calculated across household income' was listed as a primary outcome. Upon further consideration, the author team decided that since this outcome relies on the primary outcome of ownership it is more appropriate as a secondary outcome.

We were unable to conduct planned subgroup analyses to explore heterogeneity according to the following study characteristics: the type of intervention as per the logic model and framework ([Figure 1](#) and [Figure 2](#)) (e.g. cost to end user); specific population characteristics (e.g. gender/sex, ethnicity, geographic areas, rural/urban, socioeconomic status, education, age/subgroup (children under five years and pregnant women)); and the number and type of interventions in each strategy.

We planned to perform sensitivity analysis considering the relevant issues identified during the review process. For example, we planned to perform a sensitivity analysis to assess whether a difference in parameters used for reporting the use of ITNs affected our findings (e.g. ITN usage reported with the time frame 'the previous night' compared to not specifying the time frame). We planned to investigate the following study characteristics: fixed-effect versus random-effects; odds ratios versus risk ratios; studies with imputation versus without imputation for standard deviations; and RCTs versus non-RCTs.

If ITS studies were included, we planned to use a time series regression to reanalyse each comparison when accounting for unit of analysis errors, in consultation with a statistician. However, we did not include any ITSs.

INDEX TERMS

Medical Subject Headings (MeSH)

*Motivation; *Ownership; Commerce; Consumer Behavior; Controlled Before-After Studies; Health Education; Insecticide-Treated Bednets [*economics] [*statistics & numerical data]; Malaria [*prevention & control]; Randomized Controlled Trials as Topic; Reward

MeSH check words

Adult; Child; Humans