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Understanding the importance of malaria control tools by pregnant and nursing mothers is key to ending malaria burden in Nigeria: A case study of eight communities in South-South Nigeria

Nelly O. Kusimo[1], David E. Matthew[1], Blessing A. Olasunkanmi[1], Matthew E. Agwae[2] and Michael O. Kusimo[1,3]*

[1]Society Empowerment for Transformation Initiative (SETI), 10 Chief Ogbonda Street Artillery, Rumukurushi, Port-Harcourt, Rivers State, Nigeria.
[2]North West Cancer Research Centre, University of Liverpool 200 London Road, Liverpool L3 9TA, United Kingdom.
[3]Liverpoool School of Tropical Medicine (LSTM) Research Unit at the Centre for Research in Infectious Diseases (CRID), P. O. Box 13591, Yaoundé Cameroon.

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The current National Malaria Strategy Plan (NMSP) 2014 to 2020, aims to transit Nigeria from malaria control to malaria elimination status by 2020. However, the most recent WHO Malaria Report 2018 revealed that Nigeria accounted for 25% of 219 million of the global malaria cases and 19% of 435,000 malaria deaths in 2017. The strategies of NMSP among others are: To significantly scale up Indoor Residual Spray (IRS); universal coverage of Long Lasting Insecticide Net (LLIN) and emphasis on parasite confirmation before malaria treatment. This study was carried out to determine how these core strategies have impacted pregnant and nursing mothers in the proper use of these malaria control tools. We surveyed 183 nursing and pregnant mothers with a total of 560 children, most under five years, and employed quantitative questionnaire and interviewed the mothers on how their perceptions of the malaria strategies are limiting the effort of malaria elimination in Nigeria. Our findings revealed that LLIN is still low: 1 bed net to 4 persons instead of the recommended 1 to 2 persons by WHO. Over 90% believed that sleeping under LLINs produce heat and nightmares and therefore reluctant to use them. IRS is unpopular and rarely used with just 3% applying IRS for malaria bite prevention. All the women claimed to be familiar with malaria symptoms and by implication, 76% use the antimalarial drugs without parasite confirmation. The Nigerian government needs to support strategies with awareness campaign to educate on the proper use of vector control tools and the risk of drug resistance due to indiscriminate use of antimalarial drugs. It can be concluded that the war against malaria in Nigeria can only be won when the target beneficiaries are made to understand and take ownership of strategies to eliminate the malaria burden.

Key words: Malaria, parasite, vector control tools, malaria elimination, insecticide resistance, environmental pollution, malaria vaccines.

INTRODUCTION

Despite huge investments in vector control tools, drugs and several malaria control interventions, Nigeria remains at the top of a list of countries with the most significant malaria burden (WHO, 2018). Despite on-going effort by

the Nigerian government, with its "National Malaria Strategic Plan (NMSP) 2014-2020", aimed at a transition in malaria status from "malaria control" to "malaria elimination" by 2020 (Nigeria, 2014), a recent WHO Malaria report for 2018 shows Nigeria accounts for 25% of all malaria cases and 19% of deaths from the disease (Figure 2). In that report, malaria cases worldwide was put at 219 million, with 435,000 deaths due to the disease in 2017 alone (WHO, 2018). About 190 million people in Nigeria are said to be at risk of malaria infection, with a significant 145 million people, including women and children considered to be at high risk (WHO, 2018)

Among others, key strategies of the elimination program are: to scale up significantly, Indoor Residual Spray (IRS); universal coverage of Long Lasting Insecticide Net (LLIN); strategic use of larval source management; use of Intermittent Preventive Therapy (IPT) for pregnant women; emphasis on parasite confirmation before malaria treatment, and the deployment of Seasonal Malaria Chemoprevention (SMC) (Nigeria, 2014; Tesfazghi et al., 2015).Implementation of vector control tools such as LLIN and IRS, in combination with malaria drugs, has significantly changed the malaria status of a number of malaria endemic regions from that of "malaria burden" to "malaria elimination" stages (Bhatt et al., 2015; WHO, 2018; Weedall et al., 2019). This desired outcome has remained unattained across Nigeria and this is thought to be largely due to the development of resistance by the malaria vectors against the main insecticides in use for vector control tools, thereby threatening the actual objectives of the NMSP (2014-2020) (Awolola et al., 2009; Djouaka et al., 2016; Ibrahim et al., 2019). Notwithstanding the development of insecticide resistance, LLINs still offer significant protection against malaria. A 5 year evaluation survey to investigate the impact of insecticide resistance on the LLINs malaria vector control tool, demonstrated a lower malaria incidence among people who slept under LLINs in the study area, compared to those who did not use the nets (Kleinschmidt et al., 2018). It is important to note that a sample of mosquitoes in the captured area showed resistance to pyrethroids, the only insecticide approved for use in bed nets (Strode et al., 2014). This study validates the WHO recommendation of universal LLIN coverage for all populations at risk of malaria (Kleinschmidt et al., 2018).

As an NGO (www.setinitiative.org) working closely with women and keen on improving their health, we carried out a study to determine the level of their knowledge of the proper use of bed nets and the dangers of indiscriminate use of malaria drugs, and worked out the overall effect this has on malaria control and elimination in Nigeria. This survey was specific for LLIN, its level of coverage, as well as the use of IRS and parasite confirmation before malaria treatment. 183 nursing mothers and pregnant women, and a total of 590 children from 8 communities in Rivers State were recruited for the survey. Our findings demonstrate that an effective campaign system directed at the end users of the "National Malaria Strategic Plans", and aimed at educating them to take ownership of the program will be needed before malaria can be eradicated in Nigeria.

METHODOLOGY

The study design

This is a cross-sectional descriptive survey of the impacts of the National Malaria strategy plan on malaria knowledge and prevention practices using malaria control tools among pregnant and nursing mothers with children in Phalga, Etche and Obia-Akpor Local Government Areas (LGAs) of Rivers State.

Area of study

This research was conducted among pregnant women and nursing mothers with children under five years attending the clinic at the comprehensive health centres in Alakahia, Choba, Elelenwo, Mgbuoba, Ozuoba, Igbo Etche, Rumuibekwe and Rumuomasi, all in the LGAs stated above.

Sample and sampling techniques

A total of 183 respondents participated in the study by simple random sampling technique (Singh and Masuku, 2014). Questionnaire approach was used for data collection. Questionnaires were constructed to seek the opinions of the respondents on the research objectives (Phellas et al., 2011).

Method of data collection

Paper questionnaires were administered to the respondents during immunization and medical diagnostic clinics in Obio-Akpor LGA of Rivers state. The questionnaires were completed by the participants, with help rendered where necessary and the thematics of the questionnaire discussed.

Method of data analysis

Data generated was analysed in percentages.

Limitation of the study

Due to challenges of insecurity, the cover area of our study was .

*Corresponding author. E-mail: gkusimo@yahoo.com, gkusimo@gmail.com.

Table 1. Total persons and Insecticide treated bed net coverage.

Nursing and pregnant mothers	Children including those under 5	Total number of persons	Total number of bed nets	Bed net/persons	Expected bed net/persons	Bed net gap
183	590	773	219	1 / 4	1 / 2	167

Restricted to only 8 communities, slightly less than the initial plan entailed.

Ethical consideration

Consent was obtained from each respondent after verbal explanation of what the study entailed and a reassurance of confidentiality with data obtained from them.

RESULTS

Percentage of people at risk of malaria sleeping under Long Lasting Insecticide Net (LLIN)

Data was obtained from all enlisted 183 nursing mothers and pregnant women from the 8 communities of which, 73.9% are married, 23.6% divorced/separated and 2.3% widowed. Of the number, 46% were also pregnant at the time of the survey. The women had a total of 590 children, mostly under 5 years. 18% of the participants did not own this basic malaria control tool, and of the number that owned at least one, only 47% obtained theirs from official health centres at no cost, with only 60% of them sleeping under bed nets. Table 1 shows coverage to be 1/4 persons instead of the WHO standard of 1/2 persons (WHO, 2018).

As a result of air pollution from oil and gas activities in the region, coupled with soot deposits in the environment, it was necessary for the net users to have them washed on regular basis. Although the long lasting insecticide treated bed nets recommended by WHO Pesticide Evaluation Scheme (WHOPES) have been adapted to withstand up to 20 washings (with the biological activity remaining intact and lasting for 4 years), the constant washing have been shown to result to significant wears and tears (Okumu and Moore, 2011). It would be interesting to investigate the effect of the carbon soot on the efficacy of insecticide bed nets after several washes. 50% of the study participants have their occupation as small scale farming, 15% are full house wives, 20% are traders and 15% are either salary earners (primary school teachers or civil servants) or self-employed (Figure 1). This demography therefore implies that majority of the participants in this study are in a lower socioeconomic class and may be unable to afford regular replacement of the nets as at when due.

To compound the already discouraging bed net coverage of 1/4 persons, there is the well-known misconceptions among respondents about the heat effect, with over 90% of them indicating that sleeping under the LLINs does produce unwanted heat and even nightmares. They are therefore discouraged from sleeping under bed nets (Tobin-West and Kanu, 2016).

People at risk of malaria being protected by Indoor Residual Spraying (IRS)

Indoor Residual Spraying does not seem to be a popular measure in the communities surveyed. Only 3.8% use IRS while 7.1% prefer the mosquito coil. Mosquito coils are mosquito repellents usually made from dried flower heads of chrysanthemum, a natural pyrethrum insecticide (Ogoma et al., 2012). The choice of mosquito coil is thought to be due to cost and accessibility compared to the IRS (Hogarh et al., 2016). Indoor IRS sprayed on the walls in living rooms would normally kill or repel mosquitoes from the rooms (Yadav et al., 2003). A combination of insecticide treated bed nets with IRS has been demonstrated to be more effective than using only one method or approach (Ngufor et al., 2011; Okumu et al., 2013; Okumu and Moore, 2011).

Percentage of children with fever that received diagnostic test in the public health sector prior to treatment with antimalarial medication

The study showed that 90% of the women use antimalarial drugs, 4.9% use herbal medicine and the remaining combine antimalarial drugs and herbs to treat malaria. Interestingly, all the mothers claimed to know the symptoms of malaria fever. 76% of the women agreed to indulging in self-medication while treating malaria fever, with only 24% visiting clinics for diagnosis prior to treating malaria fever. Parasite confirmation before malaria treatment is a key strategy of the National Malaria Strategy (2014-2020).

DISCUSSION

Nigeria and other developing countries in Africa are required to do more in order to eradicate the malaria burden. Malaria elimination is possible with proper use of vector control tools which kill malaria vectors and the use of drugs to neutralise parasites deposited in affected persons (Atta and Zamani, 2008; Snow et al., 2013).

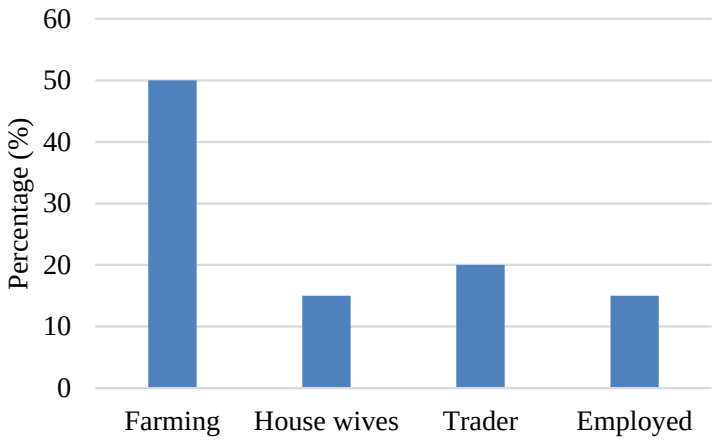

Figure 1. Employment status of the married and pregnant women that participated in this study.

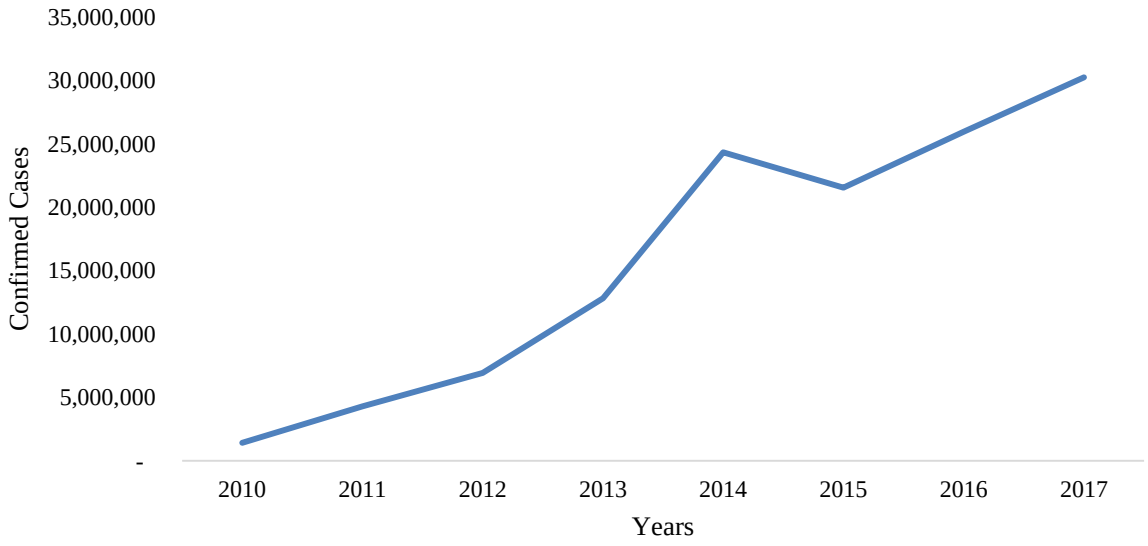

Figure 2. Malaria cases reported and confirmed in Nigeria (WHO, 2018).

There have been several malaria control and elimination programs in Nigeria since 1948 (Maduka, 2018), involving a huge amount of funds every year. There has been significant improvement but not enough to give Nigeria a malaria elimination status (Nigeria, 2014; WHO, 2018). Proper education of the populace, especially mothers who are understandably the primary targets of the malaria program, with regards to the proper use of these tools will go a long way to augment the effort of the government. The use of antimalarial medication for treatment of everyday symptoms of fever, without confirming presence of malaria parasite, will further lead to resistance. Resistance by parasites develops through mutations and could pose difficulty for vaccine production which have been proven to be effective for eradication of many vaccine preventable diseases such as smallpox (Andre et al., 2008).

Over 20 different malaria vaccines are currently under different phases of clinical trials or advanced preclinical development (Moorthy et al., 2004). The general delay in the development of an effective malaria vaccine has been attributed to the complexity of malaria parasites (Birkett et al., 2013). Four major malaria causing parasites have been identified to include: *Plasmodium falciparum, Plasmodium ovale*, *Plasmodium vivax* and *Plasmodium malariae* (Greenwood et al., 2008). The deadliest and most endemic in Africa is *P. falciparum* (Greenwood et al., 2008). Co-infection of these parasites has been reported (Tchouakui et al., 2019). The unusual length of the genes of these plasmodia, unlike those of parasites in

other vaccine preventable diseases, further makes the development of malaria vaccine difficult (Birkett et al., 2013). There are hopes that, RTS,S/AS01, which is currentlyundergoing human trials in Ghana, Malawi and Kenya (van den Berg et al., 2019) will prove an effective malaria vaccine, bringing new life to global elimination efforts.

Pyrethroid-based insecticide treated bed nets are the conventional bed nets currently in use for vector control (Rowland, 2012). Although four classes of insecticides are approved by WHO for general vector control, only pyrethroids are approved for bed nets (Hougard et al., 2003). Due to reported wide spread pyrethroid resistance, new generation bed nets comprising of pyrethroids with adjuncts such as PBO which inhibits cytochrome P450s, have now been made available (Allossogbe et al., 2017). Many more of such are also being developed (Camara et al., 2018). Adopting these newer bed nets will require evidence-based research about the insecticide resistance profile of the malaria vectors in Nigeria. While a number of reports on this resistance profile are already available, there is the need to establish the more complex resistance mechanisms (Awolola et al., 2009; Djouaka et al., 2016; Ibrahim et al., 2019).

WHO malaria report 2018 emphasises the need for more funding in malaria research and vector control tools (WHO, 2018). Providing the vector control tools free or highly subsidised is very important in order to achieve the required bed net coverage of 1 net per two persons and thereby improve usage. This is particularly important among the poor rural dwellers where household income is far too less for the purchase of vector control tools or regular replacement of worn out nets.

Recommendation

1. Scale up and effective distribution of the vector control tools in order to meet up with the required bed net coverage
2. Effective campaign and educating pregnant and nursing mothers on the danger of using antimalarial drug without parasite confirmation.
3. Campaign for IRS among the caretakers in order to take full advantage of the complementary effect of malaria vector tools
4. Effective campaign that will transfer elimination desire and ownership to primary beneficiaries of malaria elimination programs.

Conclusion

Malaria eradication in Nigeria and African as a whole will need to go beyond setting of goals and strategies. Malaria disease would only be eradicated if the primary beneficiaries of the program take ownership of eradicating the menace of mosquitoes in the region.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Allossogbe M, Gnanguenon V, Yovogan B, Akinro B, Anagonou R, Agossa F, Houtoukpe A, Padonou Gg Akogbeto M (2017). WHO cone bio-assays of classical and new-generation long-lasting insecticidal nets call for innovative insecticides targeting the knock-down resistance mechanism in Benin. Malaria Journal 16:77.

Andre Fe, Booy R, Bock Hl, Clemens J, Datta S K, John Tj, Lee BW, Lolekha S, Peltola H, Ruff T (2008). Vaccination greatly reduces disease, disability, death and inequity worldwide. Bulletin of the World Health Organization 86:140-146.

Atta H, Zamani G (2008). The progress of Roll Back Malaria in the Eastern Mediterranean Region over the past decade.

Awolola T, Oduola O, Strode C, Koekemoer L, Brooke B, Ranson H (2009). Evidence of multiple pyrethroid resistance mechanisms in the malaria vector Anopheles gambiae sensu stricto from Nigeria. Transactions of the Royal Society of Tropical Medicine and Hygiene 103:1139-1145.

Bhatt S, Weiss D, Cameron E, Bisanzio D, Mappin B, Dalrymple U, Battle K, Moyes C, Henry A, Eckhoff P (2015). The effect of malaria control on Plasmodium falciparum in Africa between 2000 and 2015. Nature 526:207.

Birkett AJ, Moorthy VS, Loucq C, Chitnis CE, Kaslow DC (2013). Malaria vaccine R&D in the Decade of Vaccines: breakthroughs, challenges and opportunities. Vaccine 31:B233-B243.

Camara S, Alou LPA, Koffi AA, Clegban YCM, Kabran JP, Koffi FM, Koffi K, Pennetier C (2018). Efficacy of Interceptor® G2, a new long-lasting insecticidal net against wild pyrethroid-resistant Anopheles gambiae ss from Côte d'Ivoire: a semi-field trial. Parasite 25.

Djouaka RJ, Atoyebi SM, Tchigossou GM, Riveron Jm, Irving H, Akoton R, Kusimo MO, Bakare AA, Wondji CS (2016). Evidence of a multiple insecticide resistance in the malaria vector Anopheles funestus in South West Nigeria. Malaria Journal 15:565.

Greenwood BM, Fidock DA, Kyle DE, Kappe SH, Alonso PL, Collins FH, Duffy PE (2008). Malaria: progress, perils, and prospects for eradication. The Journal of Clinical Investigation 118:1266-1276.

Hogarh JN, Antwi-Agyei P, Obiri-Danso K (2016). Application of mosquito repellent coils and associated self-reported health issues in Ghana. Malaria Journal 15:61.

Hougard JM, Duchon S, Darriet F, Zaim M, Rogier C, Guillet P (2003). Comparative performances, under laboratory conditions, of seven pyrethroid insecticides used for impregnation of mosquito nets. Bulletin of the World Health Organization 81:324-333.

Ibrahim SS, Mukhtar MM, Datti JA, Irving H, Kusimo MO, Tchapga W, Lawal N, Sambo FI, Wondji CS (2019). Temporal escalation of Pyrethroid Resistance in the major malaria vector Anopheles coluzzii from Sahelo-Sudanian Region of Northern Nigeria. Scientific Reports 9:7395.

Kleinschmidt I, Bradley J, Knox TB, Mnzava AP, Kafy HT, Mbogo C, Ismail BA, Bigoga JD, Adechoubou A, Raghavendra K (2018). Implications of insecticide resistance for malaria vector control with long-lasting insecticidal nets: a WHO-coordinated, prospective, international, observational cohort study. The Lancet infectious diseases 18:640-649.

Maduka O (2018). End malaria for good: a review of current strategies and future novelties for malaria elimination in Nigeria.

Moorthy VS, Good MF, Hill AV (2004). Malaria vaccine developments. The lancet 363:150-156.

Ngufor C, N'guessan R, Boko P, Odjo A, Vigninou E, Asidi A, Akogbeto M, Rowland M (2011). Combining indoor residual spraying with chlorfenapyr and long-lasting insecticidal bed nets for improved control of pyrethroid-resistant Anopheles gambiae: an experimental

hut trial in Benin. Malaria Journal 10:343.
Nigeria F (2014). National Malaria Strategic Plan 2014-2020: A Road Map for Malaria Control in Nigeria. NMCP, Abuja.
Ogoma SB, Moore SJ, Maia MF (2012). A systematic review of mosquito coils and passive emanators: defining recommendations for spatial repellency testing methodologies. Parasites and Vectors 5:287.
Okumu FO, Kiware SS, Moore SJ, Killeen GF (2013). Mathematical evaluation of community level impact of combining bed nets and indoor residual spraying upon malaria transmission in areas where the main vectors are Anopheles arabiensis mosquitoes. Parasites and Vectors 6:17.
Okumu FO, Moore SJ (2011). Combining indoor residual spraying and insecticide-treated nets for malaria control in Africa: a review of possible outcomes and an outline of suggestions for the future. Malaria Journal 10:208.
Phellas CN, Bloch A, Seale C (2011). Structured methods: interviews, questionnaires and observation. Researching Society and Culture, p, 3.
Rowland M (2012). Malaria control-achievements and prospects. Outlooks on Pest Management 23:150.
Singh AS, Masuku MB (2014). Sampling techniques and determination of sample size in applied statistics research: An overview. International Journal of Economics, Commerce and Management 2:1-22.
Snow RW, Amratia P, Zamani G, Mundia CW, Noor AM, Memish ZA, AL Zahrani MH, AL Jasari A, Fikri M, Atta H (2013). The malaria transition on the Arabian Peninsula: progress toward a malaria-free region between 1960–2010. Advances in Parasitology. Elsevier.
Strode C, Donegan S, Garner P, Enayati AA, Hemingway J (2014). The impact of pyrethroid resistance on the efficacy of insecticide-treated bed nets against African anopheline mosquitoes: systematic review and meta-analysis. PLoS Medicine 11:e1001619.
Tchouakui M, Chiang MC, Ndo C, Kuicheu CK, Amvongo-Adjia N, WONDJI MJ, Tchoupo M, Kusimo MO, Riveron JM, Wondji CS (2019). A marker of glutathione S-transferase-mediated resistance to insecticides is associated with higher Plasmodium infection in the African malaria vector Anopheles funestus. Scientific Reports 9:5772. communities of Port harcourt city, Nigeria. Nigerian Postgraduate Medical Journal 23:6.
Tesfazghi K, Hill J, Jones C, Ranson H, Worrall E (2015). National malaria vector control policy: an analysis of the decision to scale-up larviciding in Nigeria. Health Policy and Planning 31:91-101.
Tobin-West CI, Kanu EN (2016). Factors influencing the use of malaria prevention methods among women of reproductive age in peri-urban communities of Port harcourt city, Nigeria. Nigerian Postgraduate Medical Journal 23(1):6.
Van Den Berg M, Ogutu B, Sewankambo NK, Biller-Andorno N, Tanner M (2019). RTS, S malaria vaccine pilot studies: addressing the human realities in large-scale clinical trials. Trials 20:316.
Weedall GD, Mugenzi LM, Menze BD, Tchouakui M, Ibrahim SS, Amvongo-Adjia N, Irving H, Wondji MJ, Tchoupo M, Djouaka R (2019). A cytochrome P450 allele confers pyrethroid resistance on a major African malaria vector, reducing insecticide-treated bednet efficacy. Science Translational Medicine 11:484, eaat7386.
WHO (2018). World Malaria Report: World Health Organization, Geneva, Switzerland 2018.
Yadav RS, Srivastava H, Adak T, Nanda N, Thapar B, Pant C, Zaim M, Subbarao SK (2003). House-scale evaluation of bifenthrin indoor residual spraying for malaria vector control in India. Journal of Medical Entomology 40:58-63.