Insecticide-treated bednets for prevention of malaria

Steinhardt LC, Jean YS, Impoinvil D, Mace KE, Wiegand R, Huber CS, Alexandre JSF, Frederick J, Nkurunziza E, Jean S, Wheeler B, Dotson E, Slutsker L, Kachur SP, Barnwell JW, Lemoine JF, Chang MA. (Division of Parasitic Diseases and Malaria, US Centers for Disease Control and Prevention, Atlanta, GA, USA; Programme National de la Contrôle de la Malaria, Ministère de la Santé Publique et de la Population, Port-au-Prince; Division of Global Health Protection, Centers for Disease Control and Prevention, Port-au-Prince; and Population Services International, Port-au-Prince, Haiti.) Effectiveness of insecticide-treated bednets in malaria prevention in Haiti: A case–control study. *Lancet Glob Health* 2017;**5:**e96–e103.

SUMMARY

Following the earthquake in Haiti in 2010, Steinhardt *et al*. did a case–control study to assess the post-mass campaign effectiveness of insecticide-treated bednets (ITNs), which were administered in 2012 as part of a malaria control strategy.[1] This facility-based study involved 17 health facilities belonging to five departments of Haiti, which is divided into 10 departments for administrative purposes. (A department is nearly equivalent to a district.) The departments included: Artibonite, Centre, Grand'Anse, Sud and Sud-Est. The cases were individuals presenting with fever, who tested positive with a rapid diagnostic test (RDT) for falciparum malaria and controls were those who presented with fever at the health facility but tested negative by the RDT. The cases were retrospectively matched for age, gender, location of health facility and commune of residence and date of presentation. Conditional logistic regression and propensity score matching (PSM) were applied to account for confounders. The odds ratio was 0.94 (0.68–1.31) with p=0.614 with univariate analysis and 0.95 (0.68–1.32) with p=0.745 with multivariate analysis. There was no significant prevention of malaria cases with the consistent use of ITNs in 17 health facilities belonging to the five departments of Haiti. Both regression and PSM analyses yielded negative results. The study also examined the quality of ITNs using standard guidelines and whether the distributed nets met the predetermined criteria.

COMMENT

Few studies have assessed the intended functioning of ITNs. Although this study reported negative findings, it used standard and appropriate methodology along with extensive statistical analysis. It followed the WHO and Centers for Disease Control (CDC) guidelines to assess the effectiveness of ITNs using bioassay and to test resistance and integrity of the nets using chemical assay.[1,2] The authors described Haiti as a low-transmission setting (0–1 case/1000 population) whereas the WHO reports of 2012 and 2014 state that around 50% of Haiti population resides in a high-transmission setting (>1 case/1000 population).[3,4] Initially, three controls per case were matched retrospectively, but later, to improve the power of the study, four controls per case were matched. This observational study used PSM to determine causality. PSM offers a new option to account for confounding in observational studies, where randomization cannot be done. Although appropriate statistical methods have been used, there are discrepancies in the number of cases, e.g. there is no information regarding 10% missing data in the educational status of the head of the household which could affect the final number of cases and controls for the regression model.

The study was done in 2012 when the average ITN coverage in Haiti was 19% (from 9% in Artibonite to 37% in Nippes, which was not covered by the study).[5] There is a possibility that no effect

was observed in this study because of the low exposure status of the population. Such low ITN coverage despite a mass campaign suggests the need to assess community acceptance of these nets and also their efficacy/effectiveness. RDTs are not advised for diagnosis of malaria in low-transmission settings due to their lower sensitivity.[6] In a study in Artibonite, the prevalence of malaria was 3.1% using polymerase chain reaction whereas it was 0.9% with microscopy.[7] The present study used the WHO-approved RDT kit for the diagnosis of malaria.

ITNs have been proven to be effective in India.[8–11] However, a study with a similar methodology yielded similar negative results for effectiveness of bednets in India.[10] The well-known lacuna in the literature with respect to malaria in India is its under-reporting and the big mismatch in the numbers of cases reported and the actual numbers.[12] The use of long-lasting ITNs in India is one of the major strategies for malaria prevention along with indoor residual spraying and artemisinin-based therapy. ITNs have proved to be effective by not only acting as a barrier but also the insecticide content in the net is known to disable and kill mosquitoes.[13] It has been proven to be more cost-effective when compared to indoor residual spraying.[14] ITNs may not be equally effective across all regions of the country (low-endemic *v.* high-endemic regions).[8] Despite administration of ITNs across different populations in the country, certain factors, such as biting behaviour of the vector and the social behaviour of community,[11] can impact the incidence of malaria in a region. There is limited information on the comparison of ITN coverage and its impact on the incidence of malaria across various communities of India and also few studies have been done on the barriers and facilitators related to the use of ITNs despite their mass distribution. WHO recommends full ITN coverage as the goal for effective malaria vector control.[15] The sustainability of free supply of ITNs in both low- and high-endemic regions and its retreatment or replacement once in 3 years is to be made an achievable goal.

Further studies are needed to improve malaria reporting in India. Also, steps need to be taken to reduce the gap between coverage and usage of ITNs, to diagnose malaria early and correctly, and to provide prompt treatment at all levels to strengthen malaria control.

Conflicts of interest. None

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