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Increased financial accessibility and targeted education messages could increase ownership and use of mosquito nets in Purulia District, West Bengal, India

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ABSTRACT

Insecticide-treated mosquito nets are effective in reducing malaria transmission and mortality, yet they are underused for prevention. In this study, 561 households in 33 clusters were surveyed to estimate the coverage of net ownership and the frequency of use according to selected characteristics. Of the 540 participating household heads, 247 (46%) owned mosquito nets. Of 1681 individuals in households with mosquito nets, 1359 (81%) used the nets. A household monthly income ≥ 2000 Indian rupees (US\$45) was strongly associated with mosquito net ownership (prevalence ratio = 12, 95% CI 7.8–82). Factors independently associated with net use in multivariate analysis included age < 35 years ($P < 0.001$), sleeping inside ($P < 0.001$), use of repellent ($P = 0.03$) as well as knowledge that mosquitoes cause malaria ($P = 0.002$) and that malaria is severe in children ($P < 0.001$). Whilst household income is the strongest determinant of mosquito net ownership, selected knowledge elements are associated with net use. It is necessary to improve financial accessibility to nets and to communicate that malaria is a disease transmitted by mosquitoes that could be fatal in children.

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1. Introduction

Insecticide-treated mosquito nets (ITN) reduce malaria incidence, transmission and mortality.^{1–4} They constitute

a cost-effective investment in health and should become more central in malaria prevention and control efforts.^{5,6} However, low coverage can limit field effectiveness.⁷ Effectiveness depends on acceptability, feasibility and affordability. Acceptability depends on perceived benefits, the degree of inconvenience caused as well as investment of time, effort and money.⁸ Affordability varies in relation to the distribution of the financial costs between the public sector, the community and end users. The WHO formulated a position paper to maximise the public health benefit of ITNs.⁹ A World Health Assembly (WHA) resolution called for a target by which at least 60% of those at risk should use ITNs, wherever that is a method of choice.¹⁰ In 2008, the Global Roll Back Malaria action plan proposed to reach universal coverage rapidly for all populations at risk with

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locally appropriate malaria control interventions, including mosquito nets. This called for the distribution of 730 million long-lasting impregnated nets globally by 2010.¹¹ Overall, the international public health community has given a lot of attention to supply issues that have major cost implications. However, published studies refer less to the issue of actual use of mosquito nets by owners.

Malaria is reported from eight of the ten countries of the South East Asia WHO region.¹ In 2007, India reported 1.48 million cases, including 1274 deaths (Government of India, unpublished data). However, a substantial proportion of cases and deaths may be underreported. Studies since the late 1980s in India indicated that ITNs are effective in the context of local vectors.^{12–15} However, the implementation status remains unclear and little information is available regarding who owns a mosquito net and which owners actually use them.¹⁶

In 2007, the Indian state of West Bengal reported 87 754 malaria cases and 96 deaths (Government of India, unpublished data). Purulia District is hilly, poor, rural, largely illiterate and highly endemic for malaria (6454 cases and nine deaths in 2007). Transmission is perennial and two outbreaks were reported in 1999 and 2002; in 2004, 6 of the 20 community development blocks contributed 70% of malaria cases (West Bengal Department of Public Health, unpublished data). In 2005, a local evaluation of the national anti-malaria programme indicated that 46% of households owned a mosquito net. Of the mosquito net owners, only 46% (i.e. 20% of the total number of households) were using them (West Bengal Department of Public Health, unpublished data), a figure much below global targets. Hence, the current study was conducted to (i) identify factors associated with ownership of mosquito nets, (ii) identify factors associated with use of mosquito nets among mosquito net owners and (iii) formulate recommendations to improve access and use of mosquito nets.

2. Methods

2.1. Design, study population and sample

An analytical cross-sectional study was conducted in rural areas of Purulia District (91% of total population of the district, 2.5 million in 2001, census data). First, villages–clusters were selected with a probability proportional to size. Second, in each village–cluster, households were selected at random. Third, the head of household in each household was interviewed to assess mosquito net ownership. Fourth, all individuals in the households where mosquito nets were owned were interviewed to assess use. Given the 46% estimated net coverage during the recent programme evaluation, planning for 15 households in each cluster, a confidence coefficient interval of 95%, an α error of 5% and a rate of homogeneity in clusters of 0.02, 495 households in 33 clusters were required. A proportion of non-response of 10% was anticipated and the sample size was increased accordingly.

2.2. Definitions

Mosquito net ownership at the household level was defined as the presence of at least one mosquito net

(regardless of insecticide treatment), no matter whether it was used or not. Mosquito net use at the individual level was defined as the reported use of a mosquito net to sleep for at least one night per week.

2.3. Data collection

The principal investigator and four trained field workers collected information in September 2005 using two structured questionnaires. First, the head of the household was interviewed with respect to mosquito net ownership. Second, in households where mosquito nets were owned, other family members (or the guardian in the case of minors) were interviewed about mosquito net use. Finally, information was collected at the household and individual levels, including demographic characteristics, socioeconomic status as well as knowledge, attitudes and practices with respect to malaria among those aged ≥ 18 years.

2.4. Data analysis

The total number of beds used to sleep in the household was counted and was used to calculate mosquito net needs. The frequency distribution of ownership coverage was also studied expressed as a fraction of these needs. The ratio of prevalence of ownership and use among exposed and unexposed was calculated (with 95% CI). Variables were examined that were expected to be confounding factors or effect modifiers (e.g. socioeconomic status, knowledge, education, income) in a stratified analysis. A multivariate logistic regression model was generated to test variables that were significantly associated with outcomes in the univariate analysis and adjusted odds ratios were calculated. Microsoft Excel (Microsoft Corp., Redmond, WA, USA), Epi Info 2005 version (CDC, Atlanta, GA, USA) and SPSS version 11.5 (SPSS Inc., Chicago, IL, USA) were used to analyse the data.

2.5. Quality assurance

Questionnaires were drafted on the basis of rapid in-depth interviews of community members and programme managers and were subsequently pilot tested. The principal investigator validated one-tenth of interviews through observations of field procedures during supportive supervision visits (without asking the questions again to the participants).

2.6. Ethical issues

Participants were informed that participation was voluntary and that they were free to withdraw at any time. The constraints and benefit of the study were explained and written informed consent was obtained. No identifiers were written on the data collection instrument and a code was used instead. All tools and consent forms were written in Bengali, the local language. Provision for consent from illiterate subjects was made (i.e. use of fingerprints).

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