The effects of untreated bednets on malaria infection and morbidity on the Kenyan coast

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Abstract

A study was conducted in order to determine whether children that slept under untreated bednets were protected against both malaria infection and clinical disease compared with children not sleeping under bednets. The study was conducted in Kilifi District, Kenya, during the malaria season (June–August, 2000) and involved 416 children aged ≤ 10 years. Data collected from a cross-sectional survey showed evidence of protection against malaria infection among children sleeping under untreated bednets in good condition compared with those not using nets (adjusted odds ratio [AOR] = 0.4, 95% CI 0.22–0.72, P = 0.002). There was no evidence of a protective effect against infection when comparing those that used untreated bednets that were worn and those not using nets (AOR = 0.75, 95% CI 0.34–1.63, P = 0.47). When these same children were followed-up during the malaria season, there was evidence of a lower rate of clinical malaria among those that used untreated nets in good condition (adjusted incidence rate ratio = 0.65, 95% CI 0.45–0.94, P = 0.022), while the rate of clinical malaria among those that used untreated bednets that were worn was similar to that of those that did not use bednets. In the face of persistent failure of communities to take up net retreatment, there is hope that untreated nets will offer some protection against malaria infection and disease compared with not using nets at all.

Keywords: malaria, Plasmodium falciparum, bednets, Kenya

Introduction

Insecticide-treated bednets (ITBNs) have been shown to be effective in reducing malaria morbidity and overall childhood mortality in randomized controlled trials conducted in various areas across Africa (Choi et al., 1995; Lengeler et al., 1998). The only randomized controlled trial of untreated bednets was conducted in The Gambia and indicated that untreated bednets offered no significant protection against clinical malaria (Snow et al., 1988). Several cross-sectional or case-control studies have also suggested that untreated nets do not confer any significant protection against clinical malaria (Genton et al., 1994; Snow et al., 1998). However, a more detailed recent review of the available trial and cross-sectional evidence suggests that nets not treated with insecticide do offer some protection against infection and disease (Guyatt & Snow, 2002).

Due to a shortage of randomized controlled trials of untreated bednets, evidence for or against untreated bednets remains inconclusive. Strictly randomized controlled trials of untreated bednets would be ethically inappropriate in the face of the overwhelming evidence of protection afforded by treated nets. Comparative data under non-trial conditions on net use and the risks of malarial infection or disease remain our only source of evidence. Here, we describe a series of observations made on the effects of untreated bednets on the prevalence of malaria infection and clinical disease in an area of moderate seasonal malaria transmission on the coast of Kenya.

Materials and Methods

Study area

The study area was part of a wider area previously used for an ITBN trial conducted between 1993 and 1995 in Kilifi District on the Kenyan coast (Snow et al., 1993; Nevill et al., 1996). The area has an average annual entomological inoculation rate of 10 (Mbogo et al., 1995) with 2 peak malaria transmission seasons; in June-August following the long rains and in November-December following the short rains. A

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fixed geographical area was defined which comprised 72 households that were already enrolled in studies of clinical malaria. Census data from these households were used to identify children aged ≤ 10 years. A total of 488 children were identified and consent sought from their parents or guardians and 416 children were enrolled. This study was conducted from June to August 2000.

Household interviews

Interviews and observations related to bednet use and other methods of mosquito avoidance were carried out in the study households in June 2000. During the interviews, information was collected about whether the child slept under a net and where the net was obtained, whether the nets were treated and when they were last treated. Fieldworkers asked to see the nets to assess their condition. The nets were described as (i) 'intact' (no visible holes); (ii) 'satisfactory' (< 5 small holes that the user could tie into knots without compromising the net as a barrier); and (iii) 'worn' (\geq 5 holes that the user could not tie into knots without compromising the barrier effect of the nets). Nets were also considered 'worn' if they were badly damaged, e.g. by fire or had large tears.

The interviews also sought to find out whether the households used mosquito coils or local repellants. In this region the repellants used are specific plants that are burned to produce smoke that is believed to repel mosquitoes and other insects. Additional information was collected on whether the mother of each child had had any formal education.

Cross-sectional surveys

A cross-sectional parasitological survey was conducted in July 2000. Thin and thick films were made from finger-prick blood samples of each study participant. Slides were examined microscopically using × 1000 magnification and the number of parasites per 200 white blood cells (WBC) recorded. Parasite density/µL of blood was calculated assuming an average leucocyte count of 8000 WBC/µL of blood.

Surveillance for fevers

Combined active and passive case detection was maintained during the 14-week peak malaria season in the months of June to August 2000. Each study partici-