

Short Report

Re-treatment of mosquito nets with insecticide

Joanna Armstrong Schellenberg^{1,2}, Happiness Minja¹, Haji Mponda¹, Nassor Kikumbih¹, Adiel Mushi¹, Rose Nathan¹, Salim Abdulla¹, Oscar Mukasa¹, Tanya J. Marchant^{1,2}, Marcel Tanner² and Christian Lengeler² ¹Ifakara Health Research and Development Centre, P.O. Box 53, Ifakara, Tanzania; ²Swiss Tropical Institute, Socinstrasse 57, Postfach, CH-4002 Basel, Switzerland

Keywords: malaria, mosquitoes, insecticide-treated nets, net insecticide re-treatment, Tanzania

Insecticide-treated mosquito nets are a major step forward for malaria control, especially in sub-Saharan Africa where the burden of the disease is greatest. Nets have proved popular wherever they have been tried (LINES, 1996a): even poor rural families are willing and able to purchase nets with minimal or no subsidy (ABDULLA *et al.*, 2001; ARMSTRONG SCHELLENBERG *et al.*, 2001a). However, a net alone is not enough: it should be treated regularly with insecticide to give maximum protection to the individual and to the surrounding families in the village (BINKA *et al.*, 1998; LENGELER, 2001). Despite the popularity of the nets themselves, uptake of net treatment has been a continuing disappointment for public health teams. It has been suggested that selling pre-treated nets removes the opportunity to demonstrate net treatment to new users, and therefore treatment uptake might be improved if untreated rather than pre-treated nets are sold (LINES, 1996b). Despite high subsidies, attractive packaging, good availability, and strong promotion of a product which is simple and safe to use in the privacy of the home, most net users do not re-treat their nets on a regular basis (CHAVASSE *et al.*, 1999; SNOW *et al.*, 1999; HANSON & JONES 2000). Here we present data on uptake of net treatment by owners of untreated and pre-treated nets, and hypothesize that the low uptake of regular net treatment may be due in part to the failure of the product to reach expectations after it has been tried once.

The study area included 25 villages in Kilombero and Ulanga districts in southern Tanzania, with a population of around 60 000 people living in scattered rural households, described in more detail elsewhere (ARMSTRONG SCHELLENBERG *et al.*, 2001a, 2001b). Socially-marketed pre-treated nets and net treatment have been widely available in the area from June 1997. Treated nets were sold at 3000 Tanzania shillings (TSh3000 = c. US\$5 in 1997) and a home net treatment kit at TSh250 (c. US\$0.42 in 1997). A simple random sample of 450 families with children under 5 years old was drawn using the database of the Ifakara Demographic Surveillance System (ARMSTRONG SCHELLENBERG *et al.*, 2001b) in January 1998 and again, without replacement, in January 1999. In selected households, mothers or guardians of children aged under 5 years were asked about net use in the household and whether the nets in the household had been treated with insecticide.

Data were available for 389 mothers (86%) interviewed between January and May 1998 and 364 (81%)

of those interviewed between January and December 1999. Interviews were spread over the whole year in 1999 for logistic reasons, in order to ease the workload on the interview team. In 1998, 307 mothers (79%, 95% confidence interval [CI] 75–83) reported that there was at least one net in the household, and in 1999 household net ownership rose slightly to 299/364 (82%, 95% CI 78–86). In 1998 about one-quarter of the mothers who had a net in the household said that they had at some time tried net treatment (27%, 83/307) and in 1999 this figure had more than doubled to 58% (172/299, $\chi^2 = 58$, $df = 1$, $P < 0.001$). Since net ownership was very common, net treatment had been used at least once by almost half of all the households in 1999 (172/364, 47%). When the 1999 data were split into households owning only socially-marketed pre-treated nets and households with only ordinary untreated nets, 59/102 (58%) of those with pre-treated nets had treated their own nets at least once, and 47/90 (52%) of those with untreated nets had treated a net one or more times, suggesting that owners of ordinary nets and pre-treated nets were almost equally likely to have tried net treatment ($\chi^2 = 0.62$, $df = 1$, $P = 0.434$).

A separate survey in 1999 (ARMSTRONG SCHELLENBERG *et al.*, 2001a) investigated timing of net treatment in the study area and the surrounding district and revealed that only about one-third of those who slept under a treated net had treated it on a regular basis, i.e. within the last 6 months, with this proportion being similar within the villages of the current study (19/55, 35%, 95% CI 23–49) and in the entire 2 districts (64/204, 31%, 95% CI 23–41). A study of health in pregnancy in the study area (MARCHANT *et al.*, 2002) reported that the median time since last washing a treated net was 6 weeks (interquartile range 3–14 weeks).

These results are partly encouraging in that the majority of households had purchased a net and almost half of all households had tried net treatment over a two-year period. However, it is clear from comparison with the district-wide coverage of net treatment that most of those who had tried net treatment did not make a regular habit of it, since only one-third of treated net owners had treated their nets in the previous 6 months. Thus, despite the majority of families with young children having a net and almost half having tried net treatment, less than one-sixth were treating their nets on a regular basis. One explanation for the low uptake of regular re-treatment could be a widespread perception that a net alone is enough to avoid mosquito bites. Yet if this were the case why would almost half of the households have tried net treatment? Another possible explanation for the low adoption of regular re-treatment is that people were disappointed with the product after having tried it once. This hypothesis is supported to some extent by a separate question which asked whether people thought that a net with holes in it could be improved in any way. The percentage of interviewees who thought that insecticide might improve such a net fell from 184/388 (47%) in 1998 to 141/363 (39%) in 1999 ($\chi^2 = 5.6$, $df = 1$, $P = 0.02$).

For 2 reasons, we do not consider that cost alone was a major determinant of the low uptake of regular re-treatment. Firstly, nets were affordable by the majority of the population and were sold at over 10 times the price of a net treatment kit. Secondly, we carried out a limited promotional scheme of discount vouchers for net treatment, with assistance from a large local employer. Very few of these vouchers were used (less than 1%), despite a face value of TSh200, so that users paid just TSh50 (US\$0.08 in 1997) for a net treatment kit. Our experience is qualitatively different from that reported from Bagamoyo District in Tanzania (WINCH *et al.*, 1997), from The Gambia (MULLER *et al.*, 1997) and from Kilifi in Kenya (SNOW *et al.*, 1999), where

Address for correspondence: Joanna Armstrong Schellenberg, Orchard Ground Cottage, Silver Street, Cublington LU7 0LJ, UK; phone +44 (0)1296 681160, fax +44 (0)1296 681099, e-mail dajobelo@aol.com

people were very reluctant to pay for insecticide. However, in each of these studies insecticide had previously been given without charge, and cost-recovery was introduced with a resulting drop in coverage.

We found similar uptake of net treatment by owners of pre-treated nets and owners of untreated nets. Thus our findings do not suggest that selling pre-treated nets might result in lower re-treatment rates than selling untreated nets. In conclusion, most net owners did not regularly re-treat their nets even though half had tried net treatment at least once. Qualitative research within the study area (MINJA, 2001) showed that some users noticed that mosquitoes did not even touch the net during the first 2 weeks after treatment, and yet they could be seen touching the net soon afterwards. This could be a source of disappointment if users were not expecting to see mosquitoes touching the net after 3 months or more. The solution may lie in the use of longer-lasting insecticide for net treatment (GUILLET, 2001). However, new education and promotion strategies for net treatment may be useful to try to ensure that users do not expect too much of the product. Such messages could emphasize that net treatment reduces malaria incidence and mosquito numbers but will not completely eliminate either. This type of message is more complex than the simple approaches used at the start of our campaigns, but may now be appropriate to ensure continued uptake of net treatment for existing nets and a lack of disappointment after prolonged use of nets.

References

- Abdulla, S., Armstrong Schellenberg J. R. M., Nathan, R., Mukasa, O., Marchant, T., Smith, T., Tanner, M. & Lengeler, C. (2001). Impact on malaria morbidity of a programme supplying insecticide treated nets in children aged under 2 years in Tanzania: community cross sectional study. *British Medical Journal*, **322**, 270–273.
- Armstrong Schellenberg, J. R. M., Abdulla, S., Nathan, R., Mukasa, O., Marchant, T. J., Kikumbih, N., Mushi, A. K., Mponda, H., Minja, H., Mshinda, H., Tanner, M. & Lengeler, C. (2001a). Effect of large-scale social marketing of insecticide-treated nets on child survival in rural Tanzania. *Lancet*, **357**, 1241–1247.
- Armstrong Schellenberg, J. R. M., Mukasa, O., Abdulla, S., Marchant, T., Lengeler, C., Kikumbih, N., Mshinda, H. & Nathan, R. (2001b). The Ifakara Demographic Surveillance System. In: *Population and Health in Developing Countries*, vol. 1: *Population, Health and Survival at INDEPTH Sites*. Ottawa: IDRC.
- Binka, F. N., Indome, F. & Smith, T. (1998). Impact of spatial distribution of permethrin-impregnated bed nets on child mortality in rural Northern Ghana. *American Journal of Tropical Medicine and Hygiene*, **59**, 80–85.
- Chavasse, D., Reed, C. & Attawell, K. (1999). *Insecticide Treated Net Projects: a Handbook for Managers*. London & Liverpool: Malaria Consortium.
- Guillet, P. (2001). Insecticide-treated nets in Africa: where do we stand? *Africa Health*, **23**, 20–23.
- Hanson, K. & Jones, C. (2000). *Social marketing of insecticide treated mosquito nets, Tanzania. End of phase 1 social and economic analysis. Technical assistance to PSI Tanzania, final report, June 2000*. London: Malaria Consortium.
- Lengeler, C. (2001). Insecticide-treated bednets and curtains for preventing malaria. In: *The Cochrane Library, Issue 1, 2001*. Oxford: Update Software.
- Lines, J. D. (1996a). In: *Net Gain, a New Method for Preventing Malaria Deaths*. Ottawa and Geneva: IDRC, pp. 159–164.
- Lines, J. D. (1996b). Mosquito nets and insecticides for net treatment: a discussion of existing and potential distribution systems in Africa. *Tropical Medicine and International Health*, **1**, 616–632.
- Marchant, T., Armstrong Schellenberg, J., Edgar, T., Nathan, R., Abdulla, S., Mukasa, O., Mponda, H. & Lengeler, C. (2002). Socially marketed insecticide-treated nets improve malaria and anaemia in pregnancy in southern Tanzania. *Tropical Medicine and International Health*, **7**, 149–158.
- Minja, H. (2001). *Introducing insecticide treated mosquito nets in the Kilombero Valley (Tanzania): socio-cultural dimensions*. PhD thesis, University of Basel, Switzerland.
- Muller, O., Cham, K., Jaffar, S. & Greenwood, B. (1997). The Gambian National Impregnated Bednet Programme: evaluation of the 1994 cost recovery trial. *Social Science in Medicine*, **44**, 1903–1909.
- Snow, R. W., McCabe, E., Mbogo, C. N., Molyneux, C. S., Some, E. S., Mung'ala, V. O. & Nevill, C. G. (1999). The effect of delivery mechanisms on the uptake of bed net re-impregnation in Kilifi District, Kenya. *Health Policy and Planning*, **14**, 18–25.
- Winch, P. J., Makemba, A. M., Makame, V. R., Mfaume, M. S., Lynch, M. C., Premji, Z., Minjas, J. N. & Shiff, C. J. (1997). Social and cultural factors affecting rates of regular retreatment of mosquito nets with insecticide in Bagamoyo District, Tanzania. *Tropical Medicine and International Health*, **2**, 760–770.

Received 23 November 2001; revised 24 January 2002; accepted for publication 24 January 2002

Announcement

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE Denis Burkitt Fellowships

The Denis Burkitt Fund was set up by his family in memory of Denis Burkitt, FRS, who died in 1993; it is administered by the Royal Society of Tropical Medicine and Hygiene.

One Fellowship (maximum value £7000) or two separate Fellowships (of £3500 each) are awarded annually for practical training, travel, or direct assistance with a specific project (preferably clinico-pathological, geographical or epidemiological studies of non-communicable diseases in Africa).

Applications must be made at least six months before the commencement of the proposed study (by 15 March in each year). A short report on the study should be submitted, within 3 months of the recipient's return.

Application forms are available from the Administrator, Royal Society of Tropical Medicine and Hygiene, Manson House, 26 Portland Place, London, W1B 1EY, UK; fax +44 (0)20 7436 1389, e-mail mail@rstmh.org