

Use and misuse of a discount voucher scheme as a subsidy for insecticide-treated nets for malaria control in southern Tanzania

ADRIANA TAMI,^{1,2,3} JULIET MBATI,¹ ROSE NATHAN,¹ HAJI MPONDA,¹ CHRISTIAN LENGELER³ AND JOANNA RM ARMSTRONG SCHELLENBERG^{1,2}

¹Ifakara Health Research and Development Centre, Ifakara, Tanzania, ²Gates Malaria Partnership, London School of Hygiene and Tropical Medicine, UK, and ³Swiss Tropical Institute, Basel, Switzerland

Since 1997, discount vouchers for insecticide-treated nets (ITNs) have been used in two rural districts of southern Tanzania as a way to target subsidies to children under 5 years and pregnant women. We assessed appropriate use and misuse of discount vouchers through a follow-up study of 104 randomly selected vouchers. We traced these vouchers from their original issue in mother-and-child health (MCH) clinics through to being redeemed at a sales agent. We found that all vouchers that reached the target population (100%, 56/56) were used to buy an ITN. Moreover, 94% of the ITNs bought with vouchers were used by those intended, women and children under 5 years. However, up to 48% (50/104) of the vouchers had been misused at the clinics that issued them. Nevertheless, large-scale misuse occurred only at three of 21 clinics. Although most women slept under a net while pregnant, the use of voucher-subsidized ITNs during pregnancy was low despite widespread knowledge of the scheme. Parents had apparently decided to buy the subsidized ITNs once the child was born and not during pregnancy. Importantly, in 20% of households the only existing net had been bought with a voucher. Our findings suggest that vouchers are properly used by the target population, and that to minimize voucher leakage, control measures are needed at MCH clinics and to a certain extent for commercial sales agents. Increased awareness among the whole community on the right to receive a discount voucher may also help to control misuse at health facilities.

Key words: malaria, control, Tanzania, discount vouchers, targeted subsidies, insecticide-treated nets, ITN

Introduction

In April 2000, African leaders signed the Abuja Declaration, with a commitment to protect 60% of African children and pregnant women with an insecticide-treated net (ITN) by the year 2005 (WHO 2000a). ITNs have been shown to give substantial protection against malaria and anaemia in these vulnerable groups in numerous settings (Lengeler 2000; Marchant et al. 2002). Tanzania, carrying a heavy malaria disease burden with an estimated 16 million clinical episodes per year and 100 000 child deaths, recently launched a national ITNs initiative (MOH 2002). Many of the populations at most risk of malaria are extremely poor and each illness episode costs a family substantial resources (Hausmann-Muela et al. 2000). Malaria was estimated to be the cause for the loss of nearly 45 million disability-adjusted life years in 2000 (WHO 2000b) and of an estimated economic burden, measured in terms of lost opportunities for economic growth, that ranges from 0.25% to 1.30% of a country's per-person GNP growth rate (Gallup and Sachs 2000).

One way to provide general support is to lower the cost of treated nets below their current market prices by means of a subsidy, either from the government or from

an external donor. The sums involved for even a partial subsidy of ITNs for all residents in malaria-endemic areas are considerable, and difficult to sustain. In addition, such untargeted subsidies have potential to undermine the commercial sector, which is thought to have the best long-term potential for ITN distribution (RBM 2002). The Roll Back Malaria Strategic Framework for Scaling-up Insecticide-Treated Netting Programmes promotes sustained subsidies strictly targeted to high-risk groups to maximize public health benefits, while strengthening the commercial sector (RBM 2002). Subsidies can be implemented either through the direct sale of reduced-cost nets or indirectly through discount vouchers.

A social marketing programme of ITNs and net treatment, the Kilombero and Ulanga Treated Net Project (KINET), was established in 1997 in rural southern Tanzania. Within KINET, a voucher scheme for targeting subsidies of ITNs for children under 5 years and pregnant women through mother-and-child (MCH) clinics was set up (Armstrong-Schellenberg et al. 1999, 2001; Abdulla et al. 2001). Two years after implementation, few of those who were eligible for a voucher had actually received one, but nearly everyone who had received a voucher had used it (Mushi et al. 2003). Although indirect evidence

suggested that some vouchers given to eligible women had been redeemed by someone else (Marchant et al. 2002), people were unwilling to discuss this issue (Mushi et al. 2003).

Six years after the start of the KINET programme, and building on previous work (Marchant et al. 2002; Mushi et al. 2003), we followed up a random sample of 104 vouchers from their original issue in MCH clinics through to being redeemed at a shop or other agent. Our aim was to find out whether vouchers were used appropriately, that is: (1) whether vouchers issued by MCH clinics reached the intended beneficiaries (pregnant women and children), (2) whether vouchers were used to buy an ITN for the household of the intended beneficiaries, and (3) whether women and children under 5 years from households that had used a voucher to buy an ITN actually slept under a net. We therefore aimed to estimate the extent to which the subsidies reached the target population.

This study received ethical approval from the Tanzania National Medical Research Co-ordinating Committee and the London School of Hygiene and Tropical Medicine, UK.

Study design and methods

Study area

The study was conducted in Kilombero and Ulanga districts, southern Tanzania. Most local residents are subsistence farmers living in scattered households. Malaria is a major health problem and transmission is intense and perennial. Routine vaccines are given at MCH clinics and coverage is over 80%. Approximately 97% of pregnant women attend MCH clinics for antenatal care (Marchant et al. 2002). The high vaccine coverage and antenatal attendance rates show great potential to reach the population targeted by the discount voucher programme. The area is described in more detail elsewhere (Armstrong-Schellenberg et al. 2001). ITNs and net treatment, branded as *Zuia Mbu*, were socially marketed from May 1997 onwards, starting in 25 villages (phase 1 area) and expanding to the rest of the two districts within 2 years (Armstrong-Schellenberg et al. 1999; Mushi et al. 2003). As part of this programme, discount vouchers were distributed at 80 of the 81 government and non-government (generally Christian Mission) MCH clinics.

Overview of the discount voucher system

The voucher system is described fully elsewhere (Mushi et al. 2003). Briefly, the goal of the scheme was to draw attention to ITNs and increase their use by those most at risk of severe disease by reducing the price of an ITN. Vouchers were intended to be given to *all* pregnant women and mothers with children under 5 years attending MCH clinics. Their names and contact details were written on the voucher given to the woman and on the 'stub', initially kept by the MCH staff and later returned to the project.

Each voucher was worth 500 Tanzanian shillings (TSh500 \approx US\$0.8 in 1997, US\$0.5 in 2003) towards the cost of a *Zuia Mbu* ITN. *Zuia Mbu* nets were pre-treated with insecticide (not long-lasting) and were not bundled with an insecticide re-treatment kit (Armstrong-Schellenberg et al. 1999, 2001; Abdulla et al. 2001). The normal retail price of these nets was Tsh3000 from 1997 to July 2002, and Tsh3500 thereafter. Nets were available at commercial and public sector retail agents. Once used as part-payment for an ITN, vouchers were returned to the project either directly or through wholesalers.

Quantitative data collection

Tracing individual voucher owners

A random sample of 104 vouchers was selected from 7344 redeemed vouchers that had been issued between January 2000 and March 2003. These redeemed vouchers are over 95% of vouchers issued during this period, although we were unable to calculate an exact figure (Mushi et al. 2003). The sampled vouchers were evenly distributed between districts and between the phase 1 area and the rest. Each voucher showed the date of issue, name and contact details [village, sub-village and *balozi* (10-household leader)] of the woman or child receiving the voucher. These details were used to trace voucher recipients to their homes, helped by the *balozi*, who generally knows every person living in their area of roughly 10 households, as well as other community leaders.

Extensive efforts were made to trace and interview all those whose names were written on the sampled vouchers. This was particularly difficult for children, who are not always known to community leaders, so children and mothers from the neighbourhood were also asked to help. If the voucher recipient could not be found or was not available for interview, the reasons were recorded and up to five 'substitute vouchers' were used, matching village, sub-village and *balozi*, whenever possible. Respondents were previously pregnant women, or primary caregivers of children under 5 years of age, whose names were written on a sampled voucher. Written informed consent was obtained from the respondent and the household head.

Structured questionnaires were used to ask the women/carers about knowledge of the voucher scheme; whether, when and where they received a voucher and who used it; whether it was used towards the cost of an ITN; who used the net when new and who used it currently; use of nets by children under 5 years in the household; use of nets during pregnancy; and how they thought the voucher system might be improved. Because several women had purchased a discounted net directly at the MCH clinic but had not been given the voucher itself, we asked first if the interviewee had been given the voucher and if not, whether she had bought a discounted net (*chandarua kwa bei nafuu*). Nine household-level proxy markers of socioeconomic status were assessed, including income

sources, education of the household head and household assets (Mushi et al. 2003).

For any voucher said to have been used by someone other than the woman or children to whom it was issued, that person was traced and a similar questionnaire applied.

The interviewers were local staff with previous interviewing experience in health-related field studies and the ability to discuss sensitive issues. Training included a pilot study to refine interview skills and finalize the questionnaire.

MCH and retail sales agents

All the MCH clinics which had issued the sampled vouchers were visited and the clinic staff were asked if they kept records of voucher distribution. During the pilot study we found that some MCH clinics had taken the initiative to sell reduced-cost nets to their clients rather than giving out vouchers. We therefore asked MCH staff if they sold nets (and which brands) with or without vouchers. We visited all the places where the sampled vouchers had been redeemed and asked the sales agent (usually a shopkeeper) whether nets were sold with vouchers, whether more than one voucher was ever used to buy a single net, and whether vouchers were ever used to pay for other products.

Qualitative data collection

In order to gain further insight on voucher awareness, use and misuse, and on how the system might be improved, we held five focus group discussions (FGD) with pregnant women and mothers attending MCH clinics in five villages, two in Ulanga and three in Kilombero district. Purposive sampling was used to choose these five clinics: one in the main town of Ifakara, and two in each district at medium and long distances from Ifakara. In-depth interviews were held with the MCH staff responsible for distributing the discount vouchers in each of these five clinics, three of which sold nets ('net-selling') and two which did not ('voucher-only').

Data processing and analytical methods

Data were double entered and checked for consistency using Foxpro version 2.6 (Microsoft Corporation, Seattle, USA). Quantitative data were summarized using proportions and two-way tables. Data were stratified by district or phase 1 versus other area, and proportions compared using chi-squared (χ^2) tests using STATA (STATA version 7, TX, USA). Factors influencing knowledge about the voucher scheme were identified with logistic regression and χ^2 test for trend. Fisher's exact tests of significance were obtained where appropriate.

To obtain a relative measure of household socioeconomic status, the same weighted scoring of the nine household-level proxy markers was used as previously (Mushi et al. 2003), so that each household was classified into one of five quintiles of relative wealth. The weights were

developed using principal components analysis (Filmer and Pritchett 2001).

De-briefing notes were prepared after each FGD and interview session. Data were summarized by themes and compared between FGDs.

Results

Voucher tracing

Of the 104 randomly selected 'original vouchers', the person whose name was written on the voucher could only be found for 40 (38%) (Figure 1). The proportion of original 'voucher-owners' found was higher in villages outside the phase 1 area (28/57, 49%) than within it (12/47, 26%, $p=0.014$), but no difference was found between districts (data not shown). For each of the 64 remaining untraceable vouchers, 'substitute vouchers' were used. The most common reason for not being able to find the original voucher-owners was 'person not known' (47, 73%). Other reasons were that the person had moved away (14, 22%), one person had died and two were travelling without a known return date. Given that *balози* leaders generally know every person in their 10-household area, we concluded that vouchers with names of 'unknown persons' had not been issued to or used by the target population. These 47 vouchers were assumed to have been misused. They were relatively widespread amongst the villages of the originally randomly selected vouchers, which are served by 21 MCH clinics. However, in five villages, two in Ulanga and three in Kilombero, served by three MCH clinics, the interviewers found it particularly difficult to trace owners of both original and many substitute vouchers: none of the names written on these vouchers were known to the neighbours, *balози* or other community leader. Further substitute vouchers were drawn until a known person was found. This voucher was then designated as the substitute of an original voucher.

In these five villages, community leaders were puzzled that many people whose addresses suggested they were local residents were not known to them. When the three MCH clinics serving these five villages were visited, one MCH staff member said she had been unsure how the system worked and had given the voucher booklet to the sales agent who had returned it with names filled in. Another MCH staff member said that many vouchers had probably been given to short-term visitors to the village, which seemed unlikely as the *balози* would have remembered at least a few of these names.

It is important to stress that the proportion of vouchers misused presented here (Figure 1) refers to the 104 original vouchers only (the denominator), regardless of the number of substitute vouchers that were misused.

The 104 vouchers (40 'original' and 64 'substitutes') whose owners were found were traced in 70 sub-villages

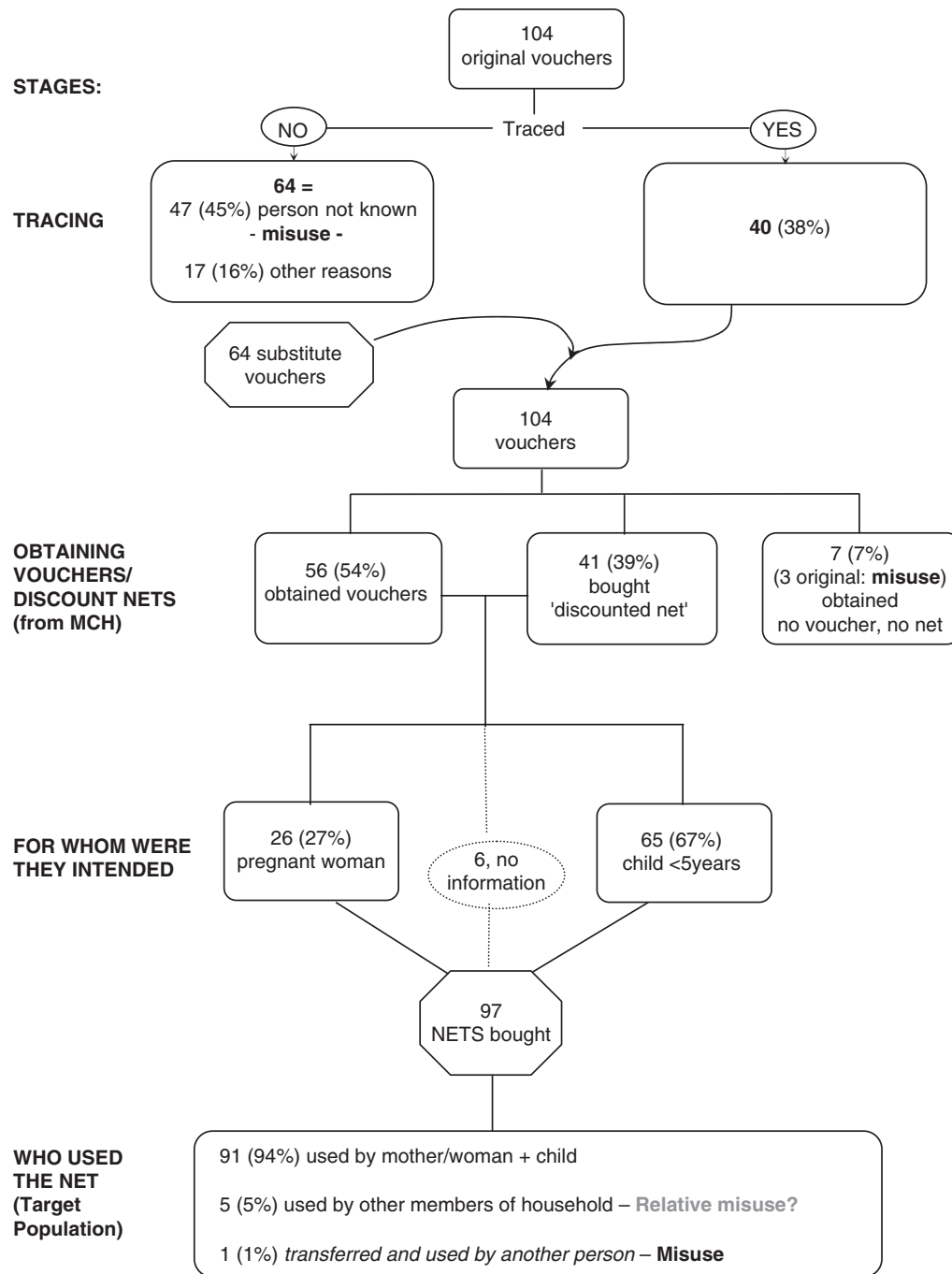


Figure 1. Use and misuse of discount vouchers and discounted nets at the different stages of issue and redemption

(*vitongoji*) from 38 villages. Six individuals (6%) had moved to a different sub-village or village and were traced there. All 104 women/carers agreed to be interviewed. Ninety-seven (93%) were women, of whom 12 were household heads. Of the seven men, one was a single father. The mean age of the interviewees was 30 years (range 16–53 years). The sampled households tended to be less poor than those described previously (Mushi et al. 2003): using the same cut-offs, we found that 81 (78%) were in the top two socioeconomic groups, rather than the 40% expected if voucher uptake were not influenced by socioeconomic status.

Knowledge of the voucher system

Twenty-eight (27%) of the 104 women/carers said they had never heard of the 'voucher system'. Of these, 21 said they bought a discounted net directly at the MCH clinic. Although interviewers used all known local terms for the system, it remains possible that women who bought a discounted net without receiving a voucher knew about discounted nets but were not aware that this was part of the 'voucher system'. Knowledge of vouchers increased with women's level of education (χ^2 test for trend, $p=0.0086$). Of those who knew about the

scheme (76), the information had mainly been obtained at health facilities (71, 93%) and from *Zuia Mbu* campaigns (4, 5%).

In all FGDs, women had some degree of awareness about the voucher scheme and of the eligibility criteria. In two groups, one from Kilombero phase 1 area and another from Ulanga non-phase 1 area, women said they had never seen a discount voucher but knew about the availability of a discounted net. In all five groups, the major source of information was said to be the MCH clinic, where women recalled taking part in health education sessions including the voucher scheme.

Voucher uptake

Obtaining a voucher

Of 104 individuals, 56 (54%) obtained the voucher at the MCH, 41 (39%) bought a discounted net from the MCH without being given a voucher, and seven (7%, three original and four substitute vouchers) said they had neither received a voucher nor bought a discounted net (Figure 1). Of the 97 people who had received either a voucher or a discounted net, 90 were women.

A total of 50 *original* vouchers were *misused* (48%, 95% CI 38–58%): 47 original vouchers had names of ‘unknown persons’ and three of people who never received them (Figure 1). Only 20/104 (19%) of the antenatal or child health cards had been marked to show whether a voucher or discounted net had been issued. Some women interviewed, and those in all FGDs, said that MCH staff did not give vouchers to all eligible women, but only to those who brought money with them to the clinic to buy a net. At MCH clinics that also sold nets, vouchers were given out for redemption at shops only if the MCH had run out of nets.

Most people (78/97, 80%) said they had only received one voucher or discounted net, but 15 (14%) had had two and four people obtained three. Those with more than one voucher or net had received them up to 6 years prior to this study. Most people (84/97, 87%) used their vouchers within 1 year of receiving them.

Voucher use by the target population

All 56 people (100%) who were given a voucher said they used this voucher (and only one voucher) to purchase a single discounted ITN. Twenty-three (41%) exchanged the voucher at a shop, 20 (36%) at a health facility and 13 (23%) went to another type of sales agent. In total, 97 people had obtained an ITN either using a voucher (56) or buying it directly (41) at the MCH clinic (Figure 1). The money to buy a discounted net was provided in 30 (31%) cases by the woman, in 62 (64%) by her husband and in the rest by another friend or relative. At least 12/84 (14%) individuals paid above the retail price for a *Zuia Mbu* net, including one who paid TSh4000, Tsh1500 more than the usual retail price at that time. Half of these individuals bought their nets in five different MCH clinics. Although

in previous surveys in this area people’s responses regarding cost of ITNs have been found to be fairly consistent with the expected price, these findings need to be treated with care.

Interviewees were asked whether it was possible to use the voucher to buy something other than a net, and if they knew of anybody having done so. Seventy-six (73%) of the 104 and 78/104 (75%), respectively, gave negative answers; the remainder did not answer (17/104, 16% and 20/104, 19%, respectively) or did not know (11/104, 11% and 6/104, 6%, respectively). The proportion of people that did not answer these questions was higher than elsewhere in the survey. Although this reluctance in addressing the above issue has also been reported previously (Mushi et al. 2003), it should be noted that our study did not find any evidence of such misuse as 100% (56 people) of those who received a voucher redeemed it for an ITN. The same view was expressed by women in all focus groups: “*that piece of paper is to get only a net; it is impossible to use it to get other commodities*” (Ulanga village, phase 1 area). In FGDs, some women said that the voucher could be used to buy a net for someone else, for example if a woman already had a net, or if she had no money but her neighbour did. Some suggested that a few women may sell the net for a profit.

Net use

For whom was the net intended and who used it when it was new?

From the information written on the vouchers, 65/97 (67%) were intended for the child and 26 (27%) for the woman herself, while six had no information (Table 1). According to the interviewees, 94% (91/97) of the ITNs were used by women or young children when newly bought (Table 1 and Figure 1). Nets had been used by 20/26 (77%) women, and by 63/65 (97%) children under 5 years. In 79/97 (81%) of the households, children under 5 years slept under nets purchased with a discount voucher (Table 1). Only one woman (1%) had transferred her voucher by buying an ITN for someone outside her family, a 66-year-old neighbour and his wife, as she already had a net. These neighbours had paid for the net. Another five (5%) voucher-owners said that the net was initially used by someone else within their own family (Table 1 and Figure 1).

Was the net still in use and by whom?

Seventy-eight (80%) of 97 net buyers still had their nets at the time of interview. All were *Zuia Mbu* nets. Net use was similar to that reported when it was new: only 4/78 were not using the net, because of “*lack of mosquitoes*”, “*the net was in a bad shape*”, or “*it was too hot*”. Those without nets said they had been damaged or burnt (11), given away (6) or stolen (2).

Of 93 households with children under 5 years, 77 (83%) reported that all under-fives (103) had slept under a net

Table 1. Net use by those originally intended to use the net: comparison of the information written on the voucher with net use when newly bought

Who used the net (Interviewees' answers)	Information written on voucher (for whom was the voucher issued)			Total
	Pregnant woman	Child	No information	
Woman alone	8	1	0	9
Woman and husband	1	1	1	3
Woman and child	7	31	3	41
Woman, husband and child	4	26	1	31
Child	1	6	0	7
Husband	3	0	0	3
Children >5yrs	1	0	0	1
Another person	1*	0	1**	2
Total	26	65	6	97

* Grandmother; ** neighbour.

the previous night. In total, 126 children under 5 years were living in these 93 households, of whom 105 (83%) had slept under a net the previous night. On average, there were two nets (range 0–6) in each of the 97 households, and 87% had 1–3 nets each. In 21 (20%) households the only net had been purchased with a discount voucher. Most of the nets (130/220, 60%) were of the *Zuia Mbu* brand.

Use of nets during pregnancy

The interviewers asked about net use during pregnancy or at the time the voucher was obtained, which was generally the most recent pregnancy. Eighty-three (92%) of 90 women interviewed slept under a net during pregnancy and of those, 22 (26.5%) had used the ITN bought with the voucher. Seventeen (65%) of 26 women given a voucher because they were pregnant used the ITN acquired with that voucher during pregnancy.

A complaint that had been made previously to *Zuia Mbu* project staff was that while women were pregnant, they could not use the net they usually shared with their husbands, as pregnant women were said to sleep apart from their partners and the net remained with the husband. However, our data do not support this view: 80/90 (89%) of the women said they had slept in the same house as their husbands when pregnant, and of these, 66/80 (83%) had shared a net with their partner. Of the 10 women who slept in a different house, eight said that they took their net with them and slept under it.

Opinions on the voucher system and how it could be improved

We asked open questions on perception of the voucher system and how it might be improved. Except for four who did not answer, all individuals said they were satisfied with the system as it helped them to purchase nets and some said it helped protect against malaria. The most frequent suggestion for improvement was to increase the value of the voucher (52/104, 50%). Others included

increased information or education about the voucher scheme, nets and malaria (9); and to give the voucher to everyone (7). When asked “should the value of the voucher be changed?”, 84/104 (81%) said it should be increased, to TSh1000 (41, 49%), Tsh1500 (24, 29%) and Tsh2000 (19, 23%). In FGDs, it was suggested that nets should be sold by all MCH clinics: “*getting a voucher from one place and a net from another is very inconvenient*” (Ulanga village, phase 1 area).

Interviews at MCH clinics where vouchers or discounted nets were obtained

The 97 vouchers/nets were obtained from 21 MCH clinics from 20 villages, 12 in Kilombero and eight in Ulanga district. Sixteen (76%) of these clinics kept some type of record of vouchers issued. In 12 (57%), nets were sold, all of them *Zuia Mbu*.

Implementation of voucher scheme

Staff interviewed at three clinics that sold discounted nets were asked why they did not issue vouchers. They said that it allowed them to check eligibility, avoided women accidentally destroying or losing the vouchers, and reduced the women's workload as they did not need to walk to another place to redeem the voucher. They thought that their approach motivated women to find the money to purchase a net. In one clinic, women could pay by instalments and this seemed to have increased net purchases, especially by very poor women. When queried why vouchers were not given to *all* eligible women, answers ranged from “*the scheme was not clear to me*” to “*such a system was already in place*”. Staff interviewed at two clinics that did not sell nets said they only gave vouchers to women who specifically wished to buy a net, and who were required to show their antenatal or child health cards.

Suggestions from clinic staff on how to improve the system

Four of the five clinic staff interviewed thought that more information on malaria, nets and vouchers was needed.

One had noticed increased net sales as a result of the health education given at the clinic. In two clinics, it was felt that nets should be always available at the clinic itself and that purchase of discounted nets should only take place there.

Interviews at sales outlets

Vouchers had been exchanged at 23 different outlets in 23 villages, including 12 health facilities and eight shops. Interviews were held at all 23 outlets: all said they sold only *Zuia Mbu* nets and accepted vouchers in partial exchange for ITNs. The clinic staff, shopkeepers and other sales agents all said that vouchers could not be used to buy anything except a net, and that only one voucher could be used for each net.

Discussion

Large-scale ITN discount voucher schemes are being implemented through programmes funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria in Tanzania, Ghana, Zambia and elsewhere (NMCP 2003; The Global Fund website: [<http://www.theglobalfund.org/en/>]). To our knowledge, this small study is the first published in-depth assessment of the use and misuse of a discount voucher scheme for ITNs. The scheme we evaluated involved relatively low-value vouchers, worth less than US\$1, on a relatively small scale of two districts in Tanzania. We have shown minimal misuse of vouchers that reached the women and children for whom they were intended; that up to half of vouchers issued had been misused at MCH clinics that issued them; and that large-scale misuse was found in only three of 21 clinics. Our findings indicate that vouchers are a feasible system to deliver targeting subsidies to vulnerable populations, but that leakage during the delivery process was the main form of misuse, clarifying previous reports (Marchant et al. 2002; Mushi et al. 2003).

We found it difficult to trace many of the people whose names were written on the vouchers, and despite extensive efforts in the field, it remains possible that we have over-estimated misuse at MCH clinics. This could have happened if, for example, women had given a false name when they were given the voucher. This possibility seems unlikely as women visit their local clinics frequently and are often well known to the staff. Furthermore, the motive for using a false name is not clear. We think it more likely that women had used their usual names and therefore that those who could not be traced had been 'invented' by MCH staff, sometimes in collusion with retail sales agents.

In three of the 21 MCH clinics which had issued our sample of vouchers, we found evidence of large-scale misuse. These three clinics served five villages where none of the names written on the originals or the five substitute vouchers were known to community leaders or neighbours. Further, individuals had been overcharged when purchasing a net, half of them at MCH clinics. In a

previous study, circumstantial evidence suggested that MCH staff were not willing to distribute vouchers and even tried to sell them (Marchant et al. 2002). These findings are not surprising as health infrastructures are poor in most African countries (Garrett 2003) and the relatively high monetary value of the vouchers can incite mismanagement. Although, optimally, programmes that are integrated will benefit each other, the extra work imposed on these delivery systems by any new programme, whether it be distribution of vouchers or of ITNs themselves, creates an additional burden on services that are already extremely fragile (RBM 2004).

Supervision of the scheme at clinic level was relatively poor. Regular supervision and checking is likely to reduce misuse at clinic level. Secondly, training of MCH staff and ongoing promotion of the voucher scheme may need to focus on the right of each woman to receive a voucher. Greater awareness among women might have made it less easy for MCH staff to withhold vouchers.

For vouchers that reached the individuals to whom they were intended, there was little evidence of misuse, and transfer of voucher or net was negligible. In fact, 100% (56) of people who received a voucher used it to purchase an ITN. Over 80% of the under-five children in these households slept under a net and over 70% used a net purchased with a voucher. There was no evidence that nets were procured using more than one voucher per net or that vouchers had been used to buy anything but a net. Importantly, in 20% of the households, the only existing net had been purchased with a voucher.

As in previous studies (Hanson and Jones 2000; Mushi et al. 2003), we found that the majority of women who used vouchers lived in the least poor households. Most of these women had a stable partner and had finished primary school, factors which were associated with a woman asking for a voucher and purchasing an ITN (Minja et al. 2001; Mushi et al. 2003). Uptake of vouchers among the poorest may be facilitated by offering easy-payment schemes (Hausmann-Muela et al. 2000), as done in one MCH clinic included in our study.

Over 90% of the women said they had slept under a net during pregnancy. However, only 27% of them obtained a voucher while pregnant and fewer still (25%) had bought and used the net at that stage. Since most pregnant women in this area present for antenatal care late in pregnancy (Marchant et al. 2002), awareness, uptake and use of the voucher scheme in this risk group was not optimal despite intensifying ITN and voucher promotion. Most women asked for a voucher or discounted net after birth and then used the net together with their baby. Women and their husbands may therefore be more motivated to spend their money on a net once the baby is born.

Although many people in our study suggested increasing the value of the voucher, none suggested a value as high as that used by the Tanzanian National Voucher Scheme [Tsh2750, (NMCP 2003)]. It seems ironic that some

women suggested in FGDs that nets should be sold at MCH clinics for convenience, as it was at these clinics that the largest problems of misuse were seen.

Our results may be of some use to those planning ITN voucher schemes on a national scale. First, this study would suggest that efforts to minimize voucher misuse might be focused at MCH clinics, and to a lesser extent at commercial sales agents. Where vouchers are distributed by MCH staff, particular attention might be paid to their training, follow-up and supportive supervision. Although voucher distribution adds to the work-load of MCH staff, it should be noted that selling ITNs is typically a much larger burden; and that a number of MCH clinics in our study who were selling ITNs were overcharging their clients. Regular audit of vouchers might be useful, including spot-checks tracing vouchers back to the person to whom the voucher was issued, as done in this study. Although relatively resource-intensive, this exercise can rapidly reveal problems at the different levels of the voucher distribution and redemption chain. Secondly, major promotion of the scheme is likely to help reduce misuse, including awareness of the right of every pregnant woman and mother of a young child to a voucher. This awareness campaign should include community leaders and men as well as women, so that they can exert their authority to control voucher misuse.

Conclusions

Our study found that discount vouchers for treated nets are properly used by the intended population, i.e. pregnant women and children under 5 years. Yet these subsidies risk leakage before they reach these target groups. Misuse of discount vouchers was found to occur commonly at the MCH clinics that issued them. To make sure that these vouchers do reach the intended population, we suggest that control systems should be aimed at MCH clinics, while increasing awareness among the whole community on the right to receive a voucher. Our findings support the use of vouchers as a feasible way to target subsidies, while indicating where to focus measures to control misuse. This information may be useful for those planning to go to scale with vouchers and treated nets in Tanzania and elsewhere.

References

Abdulla S, Armstrong-Schellenberg J, Nathan R et al. 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**: 270–3.

Armstrong-Schellenberg J, Abdulla S, Minja H et al. 1999. KINET: a social marketing programme of treated nets and net treatment for malaria control in Tanzania, with evaluation of child health and long-term survival. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **93**: 225–31.

Armstrong-Schellenberg J, Abdulla S, Nathan R et al. 2001. Effect of large-scale social marketing of insecticide-treated nets of child survival in rural Tanzania. *The Lancet* **357**: 1241–7.

Filmer D Pritchett L. 2001. Estimating wealth effects without expenditure data – or tears: an application to educational enrollments in states of India. *Demography* **38**: 115–32.

Gallup JL Sachs JD. 2000. *The economic burden of malaria*. Cambridge, MA: Centre for International Development, Harvard University.

Garrett L. 2003. Gaps between the rich and the poor. The widening differences in wealth, life expectancy, public health infrastructure and perception of threats, and the consequences for global security. *EMBO Reports* **4**: S15–19.

Hanson K, Jones C. 2000. *Social marketing of insecticide treated mosquito nets, Tanzania. End of phase I social and economic analysis. Technical assistance to PSI Tanzania, final report*. London: Malaria Consortium.

Hausmann-Muela S, Mushi A Muela-Ribera J. 2000. The paradox of the cost and affordability of traditional and government health services in Tanzania. *Health Policy and Planning* **15**: 296–302.

Lengeler C. 2000. Insecticide-treated bednets and curtains for preventing malaria. *Cochrane Database of Systematic Reviews*: CD000363.

Marchant T, Schellenberg JA, Edgar T et al. 2002. Socially-marketed insecticide-treated nets improve malaria and anaemia in pregnancy in southern Tanzania. *Tropical Medicine and International Health* **7**: 149–58.

Minja H, Tanner M, Armstrong-Schellenberg J, Lengeler C, Obrist-van-Eeuwijk B. 2001. In: *Introducing insecticide-treated mosquito nets in the Kilombero Valley (Tanzania): socio-cultural dimensions*. PhD thesis, Department of Epidemiology and Public Health, Swiss Tropical Institute, University of Basel, Basel, pp. 164–80.

MOH. 2002. *Ministry of Health. National Malaria Medium-term Strategic Plan, 2002–2007*. Malaria Control Series 8. Dar es Salaam, Tanzania: Government of Tanzania.

Mushi A, Armstrong-Schellenberg J, Mponda H Lengeler C. 2003. Targeted subsidy for malaria control with treated nets using a discount voucher system in southern Tanzania. *Health Policy and Planning* **18**: 163–71.

NMCP. 2003. *“Hati Punguzo” Tanzania National Voucher Scheme*. Dar es Salaam, Tanzania: National Malaria Control Program, Ministry of Health.

RBM. 2002. *Scaling up insecticide-treated netting programmes in Africa: a strategic framework for coordinated national action*. Geneva: Roll Back Malaria, Technical Support Network for Insecticide-Treated Materials.

RBM. 2004. *Targeted subsidy strategies for national scaling-up of insecticide-treated netting programmes: Principles and approaches*. Geneva: Roll Back Malaria Partnership. Available at: [http://rbm.who.int/partnership/wg/wg_itn/docs/ts_strategies_en.pdf], accessed 26 June 2005.

WHO. 2000a. *The African Summit on Roll Back Malaria*. WHO/CDS/RBM/2000.17. Geneva: World Health Organization.

WHO. 2000b. *The World Health Report 2000*. Geneva: World Health Organization.

Acknowledgements

We thank the respondents, MCH staff, community leaders and local authorities of Kilombero and Ulunga districts for their valuable information and cooperation; Mr Adiel Mushi, for useful comments; Mr Ngakuka for help in the training of the interviewers; Mr Martin Choma for his participation as reporter of the FGDs; Mr Adam Mbarouk for valuable information and help during the field work; and finally to the field interviewers Tabitha Edgar, Sixberth Msagua, Lucy Mwinuka and Zawadi Kapilima. This paper is published with the permission of the Director-General of the

National Institute for Medical Research in Tanzania. The study received financial support from the Gates Malaria Partnership (GMP) of the London School of Hygiene and Tropical Medicine. AT was supported by the Swiss Tropical Institute and GMP. KINET was funded by the Swiss Agency for Development and Co-operation and the Government of Tanzania.

Biographies

Adriana Tami, MD, Ph.D., is a medical doctor and an epidemiologist working with the Ifakara Health Research and Development Centre (IHRDC) and the Gates Malaria Partnership at LSHTM. Between 1991–99 she worked as a physician and researcher on malaria and other diseases among indigenous populations of the Venezuelan Amazon, followed by a year as a clinical lecturer at LSHTM and another year as an epidemiologist at the University of Nottingham. She then joined the Swiss Tropical Institute and the IHRDC as a senior scientist to work on malaria research in Ifakara, Tanzania, for 2.5 years. She currently works at the Royal Tropical Institute, The Netherlands.

Juliet Mbatia, MSc, trained as a sociologist at the University of Dar es Salaam.

Rose Nathan, Ph.D., trained as a demographer. She has worked in health research for the past 9 years. Over that period she has worked in demographic and reproductive surveys in several parts of Tanzania. In the KINET project she worked as a field coordinator of the evaluation component. She is currently coordinating a demographic surveillance site covering a population of about 70 000 people in Ulanga and Kilombero districts, Southern Tanzania. [Address: Ifakara Health Research and Development Centre, PO Box 53, Ifakara, Tanzania. E-mail: rnathan@ifakara.mimcom.net]

Haji Mponda, MSc, is a supplies and marketing professional with an interest in health promotion sciences. From 1997 to 2004 he was

the Social Marketing Manager at the Ifakara Health Research and Development Centre, with responsibilities for developing and supervising marketing plans for the distribution and promotion of insecticide-treated nets for malaria control in three rural districts in Tanzania. His previous experience includes commercial management, marketing and distribution of farm implements in rural Tanzania. [Address: Ifakara Health Research and Development Centre, PO Box 53, Ifakara, Tanzania. E-mail: mpondah@yahoo.com]

Christian Lengeler, Ph.D., is an epidemiologist who has worked for the last 15 years on the epidemiology and control of infectious diseases, mainly in Africa. Initially he worked on the individual and community diagnosis of hydatid disease and African schistosomiasis. Later he was the scientific coordinator of four large-scale WHO trials on the impact of insecticide-treated nets on child mortality. Since 1995 he has been a senior lecturer at the Swiss Tropical Institute in Basel, Switzerland, with involvement in a number of malaria control activities. [Address: Swiss Tropical Institute, P.O. Box, 4002 Basel, Switzerland. E-mail: Christian.Lengeler@unibas.ch]

Joanna Armstrong Schellenberg, Ph.D., is an epidemiologist and senior lecturer working with the Gates Malaria Partnership at LSHTM and with the Ifakara Health Research and Development Centre. From 1996–2000 she was the coordinator of the KINET project in Ifakara, Tanzania, following 5 years with the Tropical Health Epidemiology Unit at the London School of Hygiene and Tropical Medicine, and 2 years as statistician with the MRC Laboratories in The Gambia. [Address: IHRDC, Dar es Salaam Office, PO Box 78373, Dar es Salaam, Tanzania. E-mail: dajobelo@aol.com]

Correspondence: Adriana Tami, KIT (Royal Tropical Institute), Biomedical Research, Meibergdreef 39, 1105 AZ Amsterdam, The Netherlands. Tel: +31-20-566 5442; Fax: +31-20-697 1841; E-mail: Adriana.tami@lshtm.ac.uk, a.tami@kit.nl