Lessons learned from bednet distribution in Central Mozambique

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Introduction Malaria is an important cause of mortality and morbidity in sub-Saharan Africa. Use of insecticide-treated bednets (ITNs) is an important preventive intervention. Selection of the best mechanisms for distribution and promotion of ITNs to vulnerable populations is an important strategic issue.

Methods Commercial shopkeepers and groups of community leaders were trained to promote and sell ITNs in 19 sites in central Mozambique between 2000 and 2004. Pregnant women and children under 5 years of age comprised the target population. Sales records, household survey results and project experiences were examined to derive ‘lessons learned’.

Results Primary outcome: An end-of-project household survey revealed that 40.8% of households owned one or more bednets, but only 19.6% of households owned a net that had been re-treated with insecticide within the preceding 6 months. Higher levels of bednet (treated or untreated) coverage (over 50%) were achieved in urban or peri-urban sites than in rural sites (as low as 15%). Bednet ownership was significantly associated with higher socio-economic status (odds ratios for association with bednet ownership: 5.6 for highest educational level compared with no education, 0.4 for dirt floor compared with cement or other finished flooring, 2.1 for automobile ownership compared with transportation on foot), but was negatively associated with the presence of young children in the household (odds ratio 0.5). Primary output: 23 000 ITNs were sold during the course of the project. Process lessons: Nearly all of the community leader sites failed and were replaced by shopkeepers or Ministry of Health personnel. Sales were most brisk in more prosperous urban and peri-urban sites (up to 147 nets/month) but were significantly slower in poorer, rural sites (as low as three nets/month). Remote rural sites with slow sales were more expensive to serve. Logistical difficulties were related to tariffs, transport, management of cash, warehousing and organization of re-treatment campaigns.

Conclusions This project failed to achieve adequate or equitable levels of ITN coverage in a timely manner in the programme sites. However, its findings helped support a subsequent Mozambican decision to conduct targeted distribution of long-lasting nets to the neediest populations in the provinces where the project was conducted.

Keywords Malaria, bednets, Mozambique
KEY MESSAGES

- The cost of distributing, selling and/or re-treating insecticide-treated bednets (ITNs) is determined by many factors, including costs of ITN production, transportation, storage, social marketing and accounting. Because local conditions may be heterogeneous, the costs and logistical complexity of ITN programmes may vary substantially for different target populations.

- In rural Mozambique, the costs and difficulties of one ITN marketing and re-treatment programme were paradoxically greatest, and achieved ITN coverage was least satisfactory, where ITN need was most acute, i.e. in small, rural, agricultural communities located far from ports and highways. Conversely, achieved ITN coverage was greater and costs of ITN distribution were lower in wealthier urban and peri-urban communities.

- In this setting, the Ministry of Health (with the support of international donors) decided ultimately that targeted distribution of long-lasting nets at no charge was the most reasonable method of achieving high population-level ITN coverage.

Introduction

Malaria is one of the chief causes of mortality, morbidity and poverty in sub-Saharan Africa (Sachs and Malaney 2002; Hay et al. 2004; UN Millennium Project 2005). Regular use of insecticide-treated bednets (ITNs) can result in significant reductions in malaria-related acute illness and chronic anaemia (Dolan et al. 1993; D’Alessandro et al. 1995; D’Alessandro et al. 1996; Njagi et al. 2003; Phillips-Howard et al. 2003; Lengeler 2004). Where insecticide treatment of nets is properly maintained and community-level ITN coverage is greater than about 60%, ITNs even provide some protection to local ITN non-users (Maxwell et al. 2002; Hawley et al. 2003).

Achievement of high levels of ITN coverage in vulnerable populations has been defined as a high priority by various governments and international agencies (Sachs 2005). However, ideal mechanisms for achievement of population-level bednet coverage are still being defined (Worrall et al. 2005a). Much of the debate among proponents of different marketing and distribution strategies is centred on the question of socio-economic equity in access to ITNs (Barat et al. 2004; Grabowsky et al. 2005a; McNeil 2005; Worrall et al. 2005b).

In this paper, we describe one pilot ITN distribution project in central Mozambique. The aim of the project was to increase ITN utilization through promotion and sale of bednets and re-treatment supplies in 20 sites, using existing local resources to the greatest extent possible. Pregnant women and children under 5 years were targeted because they are those most in need of ITNs; no funding was yet available locally to support population-level distribution (whether mass or targeted) of free nets, and some local health authorities believed that free nets would not be valued or used by recipients (although antenatal care and child health services were provided without charge).

Throughout the region, community leaders’ councils (CLCs) had been previously established by the MoH. Their primary role was to help the MoH communicate key health messages to the local population.

Site selection

The 20 sites were each associated with a single MoH facility in nine districts that had been pre-selected by the MoH and donors as target districts for various child-survival interventions.

Baseline data

No baseline data existed regarding bednet coverage in the project districts in the year 2000; because no organized bednet distribution existed, coverage was believed to be negligible. In 2003, the Demographic and Health Survey estimated that 4.1% and 6.6% of children under 5 slept under mosquito nets in Manica and Sofala Provinces, respectively, with lower coverage in the lower quintiles of socio-economic status (UNICEF Mozambique 2005).

The bednet sales and promotion intervention

We (a Mozambique-based non-governmental organization [NGO] working in coordination with the MoH) established
our first two project sites in 2000. In one site, nets were sold by a commercial shopkeeper. In the other, they were sold by members of the CLC. Project supervisors trained community leaders and shopkeepers in key educational messages, methods for hanging and re-treating bednets, and management of funds. In both sites, community leaders, local radio stations, a street theatre troupe and local maternal and child health nurses disseminated bednet-related health messages, with the assistance of local *bairro* (community or neighbourhood) leaders.

Initially, we obtained untreated nets at a subsidized price equivalent to US$1.87 (rectangular net) and US$3.88 (conical net) each. Nets were sold to end users at prices equivalent to US$2.50 (rectangular) and US$4.00 (conical), including a free insecticide treatment kit. The end-user bednet price was the lowest possible price that we believed might support a revolving bednet purchase fund. Community leaders and shopkeepers retained the equivalent of US$0.40–0.60 for each net sold. Re-treatment kits were sold at a price equivalent to US$0.40. The insecticide originally provided by the bednet manufacturer was cyfluthrin, and the manufacturer recommended re-treatment with every washing, and/or every 4 months.

Between 2001 and 2003, we expanded the project to 19 of the 20 sites (the twentieth could not be logged for logistical reasons). Sites were assigned purposively to CLC and shopkeeper arms, so that the two groups would be balanced with regard to population size, health-facility level (health post, health centre or hospital), level of urbanization and province. Project supervisors visited each site monthly.

### Data sources and analysis

**Data on primary outcome (population-level coverage)**

In April 2004, we conducted a cross-sectional survey of household-level bednet ownership, re-treatment and use in all sites. We also collected data on household composition and socio-economic indicators. Because detailed maps and household lists did not exist for the project sites, we used a modified version of the EPI 'random walk' process to select households. The starting point was a randomly selected household located on a line drawn between each community’s centre and a randomly selected point on its periphery. We aimed to include the same number of households (40) in each community. We also attempted to interview every participating shopkeeper and at least three community leaders per community. This survey was reviewed and approved as non-research programme evaluation by the Bioethics Committee of the Mozambican National Institute of Health.

We used logistic regression to calculate odds ratios and their 95% confidence intervals for association of pertinent household characteristics, derived from 811 household interviews, with bednet ownership and use. The data were weighted to reflect design, and robust confidence intervals were used to adjust for presumed correlation of data by site. Multivariate models (using household-level ownership of one or more bednets as the dependent variable) were constructed using covariates that were significantly associated with bednet ownership in bivariate analyses and/or of intrinsic interest to the project, such as presence of members of the two target populations. Variables that did not retain their significance in multivariate models were dropped if not confounders or otherwise of interest. Finally, we discussed our preliminary findings with the project’s field-based supervisors in order to elicit their interpretations of the data.

**Data on primary output (bednet sales)**

We used monthly supervision data to calculate the number of bednets and insecticide packets sold at each site. Because sites did not initiate sales concurrently, we calculated sales both cumulatively and per month of active operation. We classified sites as ‘shopkeeper’ or ‘CLC’ sites based on the original programme assignment (Table 1).

We estimated direct costs (to the NGO) of bednet sales and re-treatment based on the cost of one supervisory visit per site per month (at US$0.43 per kilometre, plus per diem expenses of programme staff), two street theatre presentations per site (one at project inception and one at the time of the first mass bednet re-treatment campaign; US$150 each), one mass re-treatment session per quarter (round-trip transportation plus stipends for one programme staff person and two community leaders per session), one MoH supervisory visit per year (travel and per diems) and warehouse space (US$245.20/month/site). Full costing calculations were not feasible. At the time, our accounting system could not separate bednet-related staff time from other malaria-related staff time, and we were not able to obtain data on project-related costs incurred by local partners, such as the MoH.

**Data on project lessons**

We reviewed all narrative project reports, and our own experiences at site visits and in programme management.

### Results

**Primary outcome: population coverage of nets**

At least one bednet was owned by 40.8% (adjusted for sampling) of households we interviewed, although only 19.6% of households reported having treated a net with insecticide within the preceding 6 months. Higher levels of bednet (treated or untreated) coverage (over 50%) were achieved in urban or peri-urban sites than in rural sites (as low as 15%). Higher socio-economic status (as indicated by head of household education, nature of transportation, head of household occupation, ownership of radio, and quality of housing) was the best predictor of bednet ownership in multivariate analyses (Table 2), based on 811 household interviews. The presence of a pregnant woman in the household was not associated with bednet ownership and the presence of children under 5 was negatively associated with bednet ownership. Larger households were more likely to own nets. If the household head was the mother of a young child and/or had attended neighbourhood meetings about bednets, the likelihood of bednet ownership increased.

**Primary output: bednet sales**

Approximately 23 000 bednets were sold, 54% of them in sites originally assigned to CLCs. Total nets sold per site varied from 49 to 3081. Mean monthly sales ranged from three to 147 per site (overall mean, 32.8 nets/site/month), and were highest in
the early rainy season (mean sales, 81.8 nets/site/month in October) and least in the middle of the dry season (18.7 nets/site/month in June). Sales were better in relatively prosperous peri-urban areas (41.2 nets/site/month) than in rural communities (30.2 nets/site/month).

### Process lessons

#### Bednet supply, costs and sales prices

Unexpectedly, our access to subsidized nets was terminated in late 2002. In early 2003, after several months of stock-out, we arranged to buy conventional, treated nets at unsubsidized prices (approximately US$5.50 per net). Long-lasting nets would have cost approximately US$7.40 each, plus an import tax. We elected not to raise our own sales prices to compensate for the increased cost of bednets to us, because of the target population’s limited purchasing power. This decision effectively obliterated our hope of cost recovery through sales.

#### Transportation of nets

Transportation of the nets from the factory (in Tanzania) to central Mozambique was time-consuming and costly because of the long distances involved and the poor quality of roads and port facilities. Land, sea and air transport were all used at various times.

Transportation was no easier within the project region. Only about 400 ITNs fit in a standard four-wheel-drive pickup truck. Larger trucks were unsuited to the more remote local roads.

The most distant bednet sales site was located 600 km from our headquarters, thus necessitating 3 days of vehicle and staff time per visit. Initially, we underestimated the transportation-related challenges, largely because we had envisioned infrequent transport of large quantities of nets, rather than the frequent small deliveries that were ultimately required.

### Warehousing

After disheartening experiences with leaky, insecure (to thieves and fire) and/or tiny warehouses, we found adequate warehouse space in Manica Province and maintained a reserve supply of nets in a staff member’s house in Sofala Province. At the community level, nets were stored in shops or in the homes of community leaders. Most shopkeepers were able to provide secure storage without difficulty. In the homes of some community leaders, nets were subject to destruction by water and rodents.

Our warehousing needs and costs were greater than anticipated because the nets arrived in large quantities but the slow pace of sales prolonged the duration of storage of unsold nets.

#### Community leaders

The community leaders were selected prior to programme inception by local communities and MoH health facilities. Selection criteria were not standardized. Some community leaders were chosen for their leadership roles in local government, churches or women’s organizations, others...
because of previous health experience (e.g. as traditional birth attendants). Literacy, mathematical ability and sales experience were not required. Most community leaders were poorly educated and impoverished. For the 84 community leaders interviewed in our cross-sectional survey, the mean educational level was 4.9 years (95% CI: 4.0, 5.8); 51.4% lived in houses with dirt floors, and 25.9% worked in agriculture (generally as subsistence farmers).

By early 2002, it was clear that most community leaders were ill-equipped for the financial management that bednet sales required, even with monthly or more frequent supervision. In Sofala Province alone, the community leaders accumulated a bednet-related debt of over US$7000 within the first year of the programme. In consequence, many resigned from the programme. The total number of community leaders engaged in ITN sales dropped from 113 to four in Sofala Province alone.

The few remaining community leaders worked in three sites. One community leader with previous experience as a teacher and community organizer was able to manage brisk sales (mean nets sold 146/month), and the associated bookkeeping, without difficulty. In the other two sites, the community leaders collected advance payment from customers for small quantities of nets (10 or fewer), received the nets from the local MoH facility upon delivery of payment, and only then delivered the nets to their purchasers. This system facilitated management of funds, but was unwieldy.

**Shopkeepers**

The shopkeepers handled sales-related bookkeeping without apparent difficulty. However, shopkeepers lacked time and incentives for educating their customers about ITN use and re-treatment. Because many shops were located along the Beira-to-Zimbabwe highway, shopkeepers often sold nets to customers who did not reside in the target communities, e.g. long-distance truckers en route from Malawi or Zimbabwe to the Mozambican ports.

Table 3 compares the characteristics of community leaders and shopkeepers as ITN salespersons.

**Transfer of CLC sales to health-facility staff**

In the majority of the CLC sites, sales were ultimately transferred either to local shopkeepers or to MoH health-facility staff.

In the larger health facilities, pharmacy staff or clinic directors handled ITN sales using existing procedures for medication sales. This created little difficulty because sales volumes were low; higher volumes would have required the construction of additional storage space for stock. In three sites, clinic staff also accrued substantial debts to the programme, because of failure to return bednet sales proceeds.

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### Table 2

Predictors of household-level bednet ownership in multivariate analysis

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Odds ratio for association with bednet ownership</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons living in household (continuous)**</td>
<td>1.1</td>
<td>1.02, 1.23</td>
</tr>
<tr>
<td>Pregnant woman present in household</td>
<td>0.8</td>
<td>0.5, 1.4</td>
</tr>
<tr>
<td>Child under 5 present in household*</td>
<td>0.5</td>
<td>0.3, 0.9</td>
</tr>
<tr>
<td>Head of household is the mother of a child under 5**</td>
<td>2.6</td>
<td>1.9, 3.6</td>
</tr>
<tr>
<td>Head of household works in agriculture</td>
<td>0.7</td>
<td>0.4, 1.2</td>
</tr>
<tr>
<td>Education of household head:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1–3 years</td>
<td>1.8</td>
<td>0.6, 5.1</td>
</tr>
<tr>
<td>4–6 years**</td>
<td>2.6</td>
<td>1.4, 4.9</td>
</tr>
<tr>
<td>7 years or more**</td>
<td>5.6</td>
<td>3.2, 9.9</td>
</tr>
<tr>
<td>House has dirt floor**</td>
<td>0.4</td>
<td>0.3, 0.6</td>
</tr>
<tr>
<td>Household transportation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None (on foot)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Bicycle*</td>
<td>1.6</td>
<td>1.1, 2.4</td>
</tr>
<tr>
<td>Car or motorcycle*</td>
<td>2.1</td>
<td>1.0, 4.2</td>
</tr>
<tr>
<td>Household owns radio*</td>
<td>2.0</td>
<td>1.0, 3.9</td>
</tr>
<tr>
<td>Household head has attended bairro meeting on nets*</td>
<td>1.8</td>
<td>1.1, 2.8</td>
</tr>
<tr>
<td>Community originally assigned to shopkeeper sales</td>
<td>1.2</td>
<td>0.8, 1.9</td>
</tr>
</tbody>
</table>

*Association significant at level of P < 0.05.
**Association significant at level of P < 0.01.

### Table 3

Comparison of community leaders and shopkeepers as vendors of insecticide-treated bednets

<table>
<thead>
<tr>
<th></th>
<th>Community leaders</th>
<th>Shopkeepers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons initially trained to sell ITNs (2000–03)</td>
<td>152</td>
<td>9</td>
</tr>
<tr>
<td>Number of persons still selling ITNs by May 2004</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Nets sold during last month of evaluation</td>
<td>54 (only 2 of the original 10 CLC sites made any sales during this month)</td>
<td>334</td>
</tr>
<tr>
<td>Maximum accumulated debt (sales proceeds not returned to NGO), total for group</td>
<td>US$8373</td>
<td>None</td>
</tr>
<tr>
<td>Management of sales records and proceeds</td>
<td>Poor (with exceptions)</td>
<td>Excellent</td>
</tr>
<tr>
<td>Capacity for storage of nets</td>
<td>Limited</td>
<td>Very good</td>
</tr>
<tr>
<td>Education of clients re. bednet use and re-treatment</td>
<td>Very good</td>
<td>Poor</td>
</tr>
<tr>
<td>Participation in re-treatment campaigns</td>
<td>Very good</td>
<td>None</td>
</tr>
<tr>
<td>Clients</td>
<td>Community residents</td>
<td>Community residents, commercial travellers, passers-by</td>
</tr>
</tbody>
</table>
In smaller facilities, ITN sales proved not to be feasible. A single nurse was often responsible for all clinic operations, including outpatient care (up to 100 visits per day in the busy season) and attention to births and medical emergencies. Nurses in these facilities had little free time to devote to ITN sales. They were also concerned that selling ITNs in the setting of antenatal visits might create the impression that they themselves were profiting illegally by these sales. When we asked if nurses believed that antenatal and paediatric clinics were appropriate sites for bednet sales, they replied in the negative. However, most believed that it would be feasible to give bednets away without charge during clinic sessions, if adequate storage space could be found.

**Bednet sales, distribution costs and pricing**

The cost of nets was cited by CLCs, health-facility staff and 95% of survey respondents as the largest barrier to ITN purchase. For the same price as a conical bednet, local residents could purchase 20 litres of corn or a live goat.

In sites with very slow sales, the estimated cost of a monthly project supervision visit was higher than the cost of the bednets exchanged. For example, we estimate that a round-trip visit to a single site located 100 km from our headquarters cost the equivalent of US$87.00 in vehicle fuel, maintenance and depreciation, driver time and programme-staff travel expenses. Where only 19 bednets had been sold during the preceding month (for example, in the dry season), this implied the expenditure of approximately US$4.58 in travel costs for every net sold, in addition to programme staff salaries, social-marketing costs and indirect costs. However, when visits were less frequent than monthly, accurate bookkeeping was more difficult and sales sites were more likely to run out of stock.

Because the most remote sites were usually those with the highest burdens of malaria, lowest socio-economic status and most sluggish bednet sales, the result was that the per-net cost of programmatic support seemed highest where the need for ITNs was greatest. At our best-performing site, a relatively prosperous peri-urban location only 5 km from our headquarters, we estimate that our direct costs (for bednet purchase, storage, delivery, supervision visits, and support of quarterly re-treatment campaigns; assuming cost recovery of US$4.00 per net) were about US$1.75 per net; vs. US$50.59 in our worst-performing site (a community of subsistence farmers, 160 km from headquarters, sales of only three nets/month). These estimates do not include staff salaries or indirect costs, or costs incurred by partner organizations.

In addition to driving up per-net sales costs, sluggish sales at poorer, smaller, more remote locations resulted in slower attainment of sales goals. At the three nets/month pace of our worst-performing site, where no alternative source of nets existed, we calculate that it would require 203 months (nearly 17 years) to sell one net per household. Even reaching the more conventional target of 60% coverage would require a decade. In our best-performing site, 38 months would be needed to reach the 60% goal at our current sales pace if we were the only vendors; because nets were also available in the local market and in some shops, the actual pace of net acquisition was higher. Prolonged sales campaigns also prolonged cost burdens related to staff time, transportation and warehouse rental.

We would have liked to have conducted mass bednet distribution campaigns at no cost in the neediest sites, but the necessary funds were not available. Had we discontinued sales in favour of mass, free distribution in only one or two sites, we would have created resentment in the remaining sites. Had we dropped prices to a level deemed affordable by the local population, we believed that we would not have been able to afford enough nets to meet the demand.

**Social marketing**

Penetration of our social marketing efforts appeared to be good. In the survey, 95% of households reported exposure to the social marketing campaign. However, of all of the marketing modalities we used, only household head participation in meetings at which bairro chiefs advocated ITN use—our least expensive approach—was significantly associated with bednet ownership (Table 2).

**Bednet re-treatment**

By the end of the year 2002, we had only sold 1021 individual re-treatment kits (vs. over 11 000 nets). We decided to conduct mass re-treatment campaigns, with provision of re-treatment kits at no cost to those attending.

Our first two mass re-treatment campaigns attracted four and 16 people, respectively. Our third, organized by a local pastor and promoted from the pulpit, resulted in re-treatment of over 100 nets. We then wrote a new mass re-treatment protocol that called for extensive consultations with local government, the local MoH, schoolteachers, and religious and other community leaders in order to determine the optimal site and date for bednet re-treatment and to enlist their support. During the two days before each subsequent campaign, community leaders travelled through the streets making announcements by megaphone, and the street theatre troupe performed.

On the day of each campaign, the street theatre troupe performed again. Then, our supervisors demonstrated bednet re-treatment. A member of the crowd was then asked to conduct a second demonstration. Finally, the crowd was divided into small supervised groups for net re-treatment. In some cases, local schoolchildren assisted the less literate local adults.

The first 18 re-treatment sessions we conducted in Manica Province using the new protocol attracted 1587 participants, and re-treated 689 nets. However, three sessions (attracting 81, 100 and 118 nets, respectively) accounted for 43% of the re-treated nets. In other sites, turnout continued to be poor because of low levels of net ownership, inclement weather, competing agricultural or community activities, or for unclear reasons.

**Discussion**

Both shopkeeper and CLC sites failed to achieve target levels (60% or more) of ITN coverage during the pilot, and the project in general failed to achieve equity in distribution of nets. We believe that the two principal reasons were the high price of the nets relative to our own resources and to the purchasing power of the local population, and the diversion of our limited human and financial resources from bednet distribution to management of cash sales proceeds.
Although our estimated direct distribution costs in relatively prosperous peri-urban areas were similar to those reported by large distribution projects elsewhere (Stevens et al. 2005), costs were much higher in smaller, poorer, more remote rural communities. This reflects differences in population size, local purchasing power and cost of transportation of staff and nets. In our more marginalized sites, one-time free distribution of bednets could probably have raised community-level coverage and reduced the burden of malaria-related disease more quickly and more cheaply, as has been shown in some targeted distribution projects (Grabowsky et al. 2005b). Funding shortfalls prevented us from implementing this strategy at the population level, however.

Our re-treatment campaigns were costly and logistically challenging, and participation levels were unsatisfactory even though the mass re-treatment campaigns were intensively promoted and offered at no charge to the local population. New long-lasting insecticidal nets, although more expensive to purchase, would reduce the need for costly, labor-intensive retreatment campaigns.

The bulkiness and fluctuating availability of insecticide-treated bednets made them substantially more difficult to handle than the smaller commodities (medications, vaccines, condoms, laboratory testing kits) that we had previously managed. Warehousing costs were greater than anticipated, as was the need for vehicles to transport nets in quantity. The slow pace of bednet sales prolonged our need for warehouse rental and vehicle time.

Poor literacy and mathematical skills limited local capacity to support bednet sales projects, especially in the neediest sites. Our supervision costs were higher than anticipated, because of the need for frequent on-site support for bookkeeping and other management tasks.

Conclusions

This was not a formal research project, and our conclusions are not intended to be generalizable to all sites where malaria is endemic, even within Mozambique. But others have also concluded that poverty is a formidable barrier to bednet purchase (Santos 1999; Howard et al. 2003), and that large-scale targeted (or mass) distribution and/or retreatment of bednets, without charge, can be an efficient and effective technique for achieving high levels of coverage. Successful programmes have now been piloted in Ghana, Kenya and Vietnam, among other sites (Kachur et al. 1999; Guyatt et al. 2002; Guyatt and Ochola 2003; Hung le et al. 2002; Grabowsky et al. 2005b). Others have also observed that regular re-treatment of bednets seldom occurs with the desired frequency under field conditions (Guyatt and Snow 2002).

We now believe that a successful ITN distribution campaign in Sofala and Manica Provinces should have the following characteristics:

(1) Bednet promotion and distribution (or sales) should be the result of a population-level strategy, not a patchwork of small NGO efforts.
(2) Long-lasting nets (that is, nets that do not require regular re-application of insecticide) should be used exclusively.
(3) Commercial sales may be adequate in more prosperous regions with high population densities and good access to ports and/or highways, providing that vendors are required to sell only long-lasting nets or that the public sector continues to promote bednet re-treatment. But in districts with high combined burdens of poverty and malaria—especially where geographically isolated—long-lasting nets should be given to local residents without charge.
(4) Community leaders and local health workers should be enlisted to educate the public about ITN use in local languages, and to serve as liaisons between target populations and bednet programmes.
(5) Cost estimates for large-scale ITN distribution—particularly in remote rural areas—should pay close attention to costs of adequate warehousing and transportation, both at central and at peripheral levels.

Central Mozambique, like other regions of sub-Saharan Africa, is now struggling with the combined burdens of poverty, malaria and HIV infection. Both human and material resources are limited. Thus, we believe that the fastest, least expensive, most durable means of reducing malaria transmission is the best policy choice. Journeys of 200 km to sell three bednets, or to treat four of them, are inconsistent with this vision.

We presented our project results and conclusions to national and provincial-level stakeholders during a period of rapid change in malaria policy. Subsequently, Mozambique—with the support of various international agencies—conducted a large-scale targeted distribution of long-lasting insecticidal nets, without charge to the recipient, in conjunction with childhood immunization campaigns in Sofala and Manica Provinces. Mozambique’s efforts to provide affordable, population-level coverage of other key malaria interventions have also expanded dramatically since the inception of the project described in this paper; if we were to start over now, our approach—and that of our partners—would be quite different.

We hope that the lessons learned from bednet distribution in central Mozambique may help other projects and populations to plan successful programmes at the population level, without first experiencing similar wastage of precious resources and time.

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Stephen Gloyd, MD, MPH, conceived this project and served as the principal investigator.
References