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January 21, 1998

Ms. Joan Larosa
Chief, HPN Office
USAID
NICO House
Lilongwe 3, Malawi

Dear Joan:

Subject: Grant No. 612-0231-G-00-5003-00 Impregnated Curtains for Malaria Control in Mangochi

Enclosed please find two copies of the final report for the referenced grant. Submittal of the report has been delayed pending technical review and comment from Dr. Wilfred Nkhoma, Controller of Preventive Health Services, and Dr. Okey Nwanyanwu, CDC/USAID. While final comments have not yet been received from these key advisors to the project, I would nonetheless like to submit the report as finalized by the primary authors Marcie Rubardt and Deborah Glik. If the eventual comments from the technical advisors require revisions to the report, a revised copy will be submitted.

Overall, the findings of the three studies used to assess curtain efficacy were mixed and were affected by multiple exogenous factors. The findings did indicate, however, that project participants were highly satisfied with the curtains and were willing to invest cash (equivalent to US\$1.30 at the time) to redip them in permethrin when they had cash available.

We look forward to discussing the project findings with you, particularly in regards to lessons learned and possible follow-on activities. In the meantime, please contact us with any questions or comments you may have regarding the report.

Sincerely,



Tom Krift
Director

cc: Joseph de Graft-Johnson
USAID/CDIE/DI ✓

MANGOCHI IMPREGNATED CURTAINS PROJECT FOR MALARIA PREVENTION

Final Report – August, 1997

Submitted by Marcie Rubardt and Deborah Glik

Special Acknowledgements to:

Dr. Okey Nwanyanwu for technical assistance and support

Dr. Wilfred Nkhoma for training assistance and ongoing Ministry of Health support

Augustine Chikoko, with Stan Jere's help, for managing the project day to day on the ground

Khozapi Mtonga for managing all the data entry

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I. EXECUTIVE SUMMARY

The Mangochi malaria prevention project, funded by the United States Agency for International Development, was implemented in the Chilipa impact area of Mangochi District from July, 1995 – August, 1997. It undertook to document the operational issues involved in implementing an impregnated curtains intervention in a rural Malawian village setting. It was added to an ongoing Child Survival project in the Chilipa area leading to an enhancement of each project's scope and impact. Surveys, focus groups, blood tests for parasitemia and anemia levels, and ongoing monitoring of utilization and compliance were used to track use rates, implementation issues, satisfaction levels, and effectiveness of the intervention. In addition, the Child Survival project provided drug boxes in each village allowing for early treatment of fever/malaria with Sulfadoxine Pyramethamine (SP) and additional health education using the Child Survival village health promoters and health surveillance assistants.

Results indicate that people were extremely satisfied with their curtains, and that a significant change occurred in beliefs regarding malaria and whether they could do something about it. Actual behaviors changed not only around curtains, but around other malaria prevention activities as well. After the initial installation, redipping with permethrin was unsubsidized in order to determine the intervention's level of sustainability and acceptance. 76% of people with curtains redipped the first time, however, this dropped to 53% the second time. This was probably because the dipping occurred during pre-harvest time when people have no disposable cash. The second dipping was fully managed by the villagers themselves.

With respect to efficacy, a slight difference in parasitemia levels between intervention and control villages was seen midway through the project. However, this difference disappeared by the end of the project. There was a significant difference in anemia levels between the two groups when measured at the end of the project. The marginal parasitemia impact at final measurement was probably due to a combination of exceptionally heavy rains with high malaria incidence, and decreasing compliance. The researchers suggest that anemia levels may be a better indicator of long term exposure to malaria whereas parasitemia is more immediate. This would explain the statistical difference for anemia in spite of the more intense malaria season this year where the difficulty in controlling exposure may have led to the higher parasitemia levels in both groups. A permethrin knock down measurement done in June, 1997 for numbers of mosquitos in houses showed no statistical difference between curtains, non-curtains, and control houses. Again, this may have been due to very low numbers of mosquitos in general (it was after the rainy season), and/or decreasing compliance.

The underlying observation throughout the project, was that people are extremely poor and any additional expenditure is a burden. There was no available cloth in any household which could be converted to curtains. In addition, while dipping was possible immediately after harvest, people did not have the ability to maintain available cash for dipping when confronted with the more immediate cash requirements for food, seed and fertilizer of the pre-harvest season.

There are several significant conclusions to be drawn from this project:

1. This is a low technology intervention that is possible to implement and maintain at the village level given funding for the initial inputs. Malaria and mosquitoes are serious problems and people are willing to go to considerable effort to try and control them. However, the level of poverty in rural Malawi precludes people being able to afford curtains on their own, and also makes it very difficult for people to afford redipping during the pre-harvest time even though this is the time of highest malaria incidence.
2. More work needs to be done to determine whether the lack of impact on parasitemia levels during the final measurement may be attributable to lack of efficacy, implementation inconsistency, the unusually heavy malaria season, or insufficient measurement. On the other hand, the significant impact on anemia levels would indicate that curtains may, in fact, be efficacious when considered longer term. This project therefore indicates that impregnated curtains are probably not the stand alone

solution to malaria control, but may be helpful as an adjunct intervention along with other malaria prevention efforts.

3. The implementation of this project in conjunction with the Child Survival project led to cost savings and enhanced impact for both projects due to the expanded focus of each. The trust relationship already established with SC staff also increased motivation.
4. This was a demonstration project meant to primarily assess the behavioral and implementation issues with curtain acceptance. Gaps in efficacy data such as early measurements for anemia and mosquito levels in houses make it more difficult to draw conclusions about impact.

II. BACKGROUND

Save the Children Federation (SC/US) began working in Mangochi District in Sept. 1993 through the inauguration of a Child Survival project in the Chilipa Impact area. This project trained 23 health surveillance assistants (HSA) and 132 volunteer village health promoters (VHP) to carry out preventive health interventions at the village level. Among other Child Survival interventions, the early treatment of malaria facilitated by establishment of drug revolving funds was part of this project. The Chilipa area was selected for the malaria project because the ongoing Child Survival project provided a base on which to build the malaria education and prevention intervention as well as staff and infrastructure to assist with its implementation. Meanwhile, the impregnated curtains provided an enhancing intervention to the Child Survival prevention efforts. In 1997, a pilot project in "Integrated Management of Childhood Illness" also provided additional enhancement to both of the other projects through focusing on appropriate fever management at the clinic and household levels.

Throughout Mangochi District, malaria is a major cause of morbidity and mortality. In the Chilipa area, the Child Survival baseline survey (done in Dec. 1993) reported that 35% of children under two had experienced fever within the past two weeks, and only 32% of mothers knew that malaria was caused by mosquitoes. It also reported less than 3% of households had a bednet. November – April/May is the rainy season, and the high malaria season occurs towards the end of the rainy season. During baseline focus group discussions malaria was listed as one of the leading health problems by all groups, and malaria related anemia is the most common cause of hospital admission for children under five during the rainy season.

There were several reasons why the impregnation of curtains rather than bednets was selected as an intervention to reduce malaria. These included:

1. the high cost and low initial availability of bednets in households in this area of Malawi,
2. curtains were culturally compatible with existing social norms for status and household beautification,
3. there were concrete observable outcomes (dead mosquitoes) and visible curtains in windows and doorways,
4. their adoption was easy to explain to villagers
5. curtains protect the entire household while bednets primarily protect those sleeping under them (which is most often the man – not the woman and children)
6. it was thought that curtains would last longer than bednets, particularly since bednets are tucked into mats with rough edges on the floor leading to easy tearing, and
7. there is general consensus that permethrin toxicity is minimal.

There had been studies both in Kenya (Sexton, J. et al "Permethrin Impregnated Curtains and Bednets Prevent Malaria in Western Kenya" 1990) and in Mali (Duombo, O. et al, "Impact des Rideaux et couvertures Impregnees de Permethrine sur les Indices Paludometriques dans un Village d'Hyperendemie Palustre de Savane Malienne", 1991.) indicating that curtains were effective in decreasing malaria. However, little had been done to explore the barriers and enhancing factors for their adoption in a sustainable way.

III. PROJECT IMPLEMENTATION

There were three original objectives to this project:

1. To measure community willingness in eight villages to accept, pay for, use, and maintain impregnated curtains in their homes.
2. To assess factors which may contribute to or detract from acceptance of impregnated curtains. (e.g. knowledge levels, design, cost, economic status, etc.)
3. To experiment with and document cost recovery and community participation models to establish sustainability for such a project.

A fourth, to evaluate the impact of curtains on outcome measures of parasitemia and anemia levels, was added during the development of the implementation plan for the project.

In order to achieve these objectives, the project carried out social marketing campaign combined with community mobilization techniques to encourage adoption, logistics management to procure and distribute curtains and permethrin, and data management to adequately document the changes in predictive and acceptance factors in the adopters versus the non-adopters. The project was carried out in two phases. The first was a curtains for work phase where the first approximately 100 households in each village were provided curtains in exchange for designated sanitation work projects around their house. During the second phase, social marketing and monitoring continued but villagers were expected to pay for and manage ongoing dipping and additional people wanting curtains were required to supply their own cloth.

A. STUDY DESIGN

This project was set up using a quasi-experimental design with surveys, focus groups and observations to measure change. Key research questions to be answered included:

1. Are permethrin impregnated curtains are acceptable and desirable when introduced among target village populations using self-help work incentives to enhance distribution?
2. What are the differences between acceptors and non-acceptors of Medicine Curtains?
3. What is the feasibility and viability of continued use and redipping of curtains over time?
4. What is the efficacy of impregnated curtains in lowering transmission rates of malaria?
5. What are the barriers and cost per household for continued use and how do they influence sustainability?

Eight intervention villages were purposively selected using geographic spread in the impact area, village size, estimated socio-economic status (SES), and malaria levels as criteria. Four control villages were then purposively selected to match. Baseline and final focus group discussions, baseline and final KAP surveys including collection of parasitemia slides in intervention and control villages, intermediate KAP surveys and collection of parasitemia slides in intervention villages, and ongoing monitoring and observation for appropriate maintenance and use were the tools used for evaluation.

Sixteen baseline focus groups discussions were carried out to provide information for survey design, to obtain an indication of the general acceptability of the curtains, to get a sense of current mosquito and malaria prevention attitudes and practices, and to assist with the development of project messages. While the plan had been to complete focus groups in both intervention and control villages, the responses from those first carried out in the intervention villages were so homogeneous that it was not deemed necessary to continue.

The baseline survey including blood smears for parasitemia levels was completed in both intervention and control villages by November, 1995. A clearance dose of SP was then distributed to all children under five in both intervention and control villages. A similar KAP survey adapted to include experience with and use of Medicine Curtains as well as repeat parasitemia smears was subsequently carried out in intervention villages in May, 1996 and November, 1996. In April, 1997, the same KAP survey with parasitemia smears was again carried out in both intervention and control villages to monitor the impact and change in the

intervention villages as contrasted to the control. Anemia levels were also measured on a sub-sample of under-five children during the final survey. The KAP sample for both the intervention and control villages was 100% of households, while a 33% sample of children under five was used for collecting the blood slides during the first three rounds of data collection. During the final survey, a 100% sample of one child under five per household was used in order to assure the necessary statistical power.

During the intervening time, the control villages continued to be part of the Child Survival project as well as to participate in community mobilization and education around malaria prevention. They did not receive any curtains for work, although those who wanted to dip their own curtains were encouraged to do so.

Throughout the course of the project, staff kept careful records of activities carried out and the levels of participation. These included dipping sessions, curtains for work, permethrin revolving funds, and tracking those who independently brought their own cloth for dipping. Malaria helpers stationed in every village monitored appropriate use of the curtains by those who had them. Social pressure also served to support appropriate use as people who took down curtains to wear them as skirts were discouraged by their neighbors.

Lastly, a Permethrin Knockdown study was carried out by a local entomologist in May, 1997 sampling several houses from each of the adopter, non-adopter, and control groups. This was to determine whether mosquito levels in the houses were affected by the curtains and in what ways.

Dr. Deborah Glik from University of California Los Angeles School of Public Health and Dr. Okey Nwanyanwu from USAID provided technical support with respect to research design, behavioral science, and malariology throughout the project. Dr. Glik was hired as a behavioral scientist consultant to carry out the focus group discussions, to develop the survey tools, and to establish the overall research design. She also did all of the statistical analysis of the data. She was in Mangochi in July, 1995 and in February, 1997. Dr. Nwanyanwu provided the malaria expertise as well as availability for on the ground consultation since he was based in Lilongwe.

B. PROJECT STRUCTURE

The implementation of the malaria project was very interdependent with the implementation of the Child Survival project in the same area. Both had the objective of decreasing morbidity and mortality due to malaria and both involved health education for behavior change at the community level such that the malaria project provided a way to considerably enhance one of the several Child Survival interventions. Meanwhile, the Child Survival project provided the structure into which the malaria project was integrated. Child Survival staff included 23 HSAs employed by the project to provide preventive services, supervise VHPs, and assist with prevention education at the community level. In addition, the Child Survival project recruited and trained 132 VHPs and 20 literacy instructors to also carry out education and mobilization activities in their communities. As a result, there was already significant progress towards the introduction of community preventive health activities and community awareness of health issues by the time the malaria project began.

The malaria project "hired" eight malaria helpers for a stipend of \$7.00/month to work primarily as community volunteers assisting with the implementation of Medicine Curtains in their villages. The money served as an incentive since data collection and routine monitoring for the sake of the research in addition to the tasks benefiting the community were expected. These helpers worked side by side with the VHPs, with oversight from the village health committees, and both were supervised by the HSAs.

The Child Survival project also enhanced the malaria project through the establishment of drug revolving funds (DRF) in the villages. These were set up under the management of the health committees and the VHPs to make essential drugs available at the community level to treat illnesses that acutely affect particularly children under five. SP was included as part of the fund stock, and was prescribed under a protocol for fever management by the VHPs.

The other component that grew out of the Child Survival project which enhanced the malaria project was the early introduction of Integrated Management of Childhood Illness (IMCI) protocols in the area. While the focus of the pilot was primarily at the health center level, the concept of considering fever, respiration, and diarrhea together in an integrated way was carried over into the case management at the village and household levels.

C. PROJECT ACTIVITIES

This project included several types of activities:

1. distribution and installation of curtains through curtains for work and other logistic systems,
2. health education and message dissemination regarding malaria prevention and curtain maintenance,
3. redipping and establishment of permethrin revolving funds managed by the health committees,
4. the necessary training of community volunteers and SC/US staff to support these activities and
5. data collection to support the research design.

1. CURTAIN DISTRIBUTION

The curtain distribution was divided into two phases. The initial distribution was done through curtains for work as a mechanism to introduce a new intervention while not providing it for free. During later distribution, people were expected to supply their own cloth for curtains - having presumably been convinced of the benefit by the curtains for work demonstration curtains.

The initial costs for curtains, permethrin, and installation were all met by the project. These worked out to be approximately US\$28 (MK420)/household. Of this, about US\$ 26.50 was spent on the cloth for the curtains, and the remaining US\$1.50 covered the costs of the tailors, installation materials, dipping materials, and permethrin. While this looks expensive up front, one of the assumptions of the project was that people would manage to find old and/or cheap cloth if it was important to them to have curtains. The supplemental costs for installation and dipping were quite reasonable.

Levels of work relative to meters of cloth to be received as curtains for work were outlined by project staff and agreed to by village representatives. Examples of work completed included cleaning up of weeds in the compound, construction of latrines and/or separate kitchens, plastering walls, and digging drainage ditches. These tasks were all individual rather than community oriented tasks, since the project was not primarily a work project and there were too many other necessary tasks for staff to spend a lot of time organizing community work projects. There were a significant number of people who did not manage to do the work, indicating that it did require an intentional effort on the part of the beneficiary in spite of the work also providing direct benefit to the individual household.

Once the work was completed, the malaria workers measured the windows and eaves and the project employed local tailors to sew curtains according to the prescribed measurements. The initial focus groups had indicated that the eaves were an important source of ventilation in the house since people did not feel comfortable leaving windows and doors open at night due to thieves. As a result, the project procured light cotton cloth for the window coverings, and netting for the eaves. Community dipping in centralized buckets was organized when the curtains were ready for installation. 25% emulsifiable concentrate permethrin was diluted 30ml./liter water for the cotton dipping solution, and 35ml./liter water for the net dipping solution to give a net concentration of .5 gm. of active ingredient/square meter of cloth or netting. Training for installation was provided during the initial dipping session, and the malaria helpers were available in each village to oversee the installation and provide assistance where necessary.

The number of households to receive curtains for work was limited to approximately 100 per village, selecting those first to complete the required work. This was done both for budgetary reasons, and because curtains for work was only meant as an introductory offer. The purpose of the study was to look at who and how curtains would be independently adopted as well as to look at what happened in terms of efficacy and redipping after the curtains were installed. This would not have been possible if everyone were offered curtains for work. 815 houses in 744 households were provided curtains for work, with distribution by

village shown in the following table. The SES and malaria levels also indicate how each village was categorized for the purposive sample selection including them as intervention villages. Mwatakata lagged behind in completing their curtains for work tasks, while Nikisi and Chalenga were selected to make up the deficit at the deadline because they had more than the eligible number of people who had completed the tasks.

Table 1 – Adopters and Non-adopters by village

Village	Adopters		Non-adopters		SES Level	Malaria Level
	n	%	n	%		
1-Mwatakata	64	21.5	187	78.5	lower	higher
2-Matenje	100	38.6	182	61.4	lower	lower
3-Nikisi	124	52.3	113	47.7	higher	higher
4-Chalenga	118	50.6	125	49.4	lower	higher
5-Mitawa Midondo	100	42.9	131	58.1	higher	higher
6-Naunje	100	63.6	57	37.4	lower	higher
7-Mtendere	100	67.5	48	32.5	higher	higher
8-Mkaweya	100	44.6	124	55.4	lower	lower

After the initial curtains for work distribution, there were 208 households who brought their own cloth for dipping. Most of these were from the control villages, although a few were from other Child Survival villages in the impact area. The project provided free dipping for the first round, and assistance with installation for these households.

2. HEALTH EDUCATION AND MESSAGE DISSEMINATION

Health education regarding malaria and its prevention, as well as social marketing of Medicine Curtains were key activities in this project. The primary people responsible for carrying out the education and mobilization were the malaria helpers with the support of the VHPs and the HSAs. Word of mouth modalities such as community meetings, peer mobilization, and drama groups were emphasized due to the high illiteracy rate in the project villages. Based on the focus groups, messages were developed in five categories: Informational, Overcoming Objections, Intervention Benefits, Logistic, and Increasing Motivation to Comply. The informational and intervention benefits messages included the relationship between mosquitoes and malaria, ways to prevent malaria, added benefits such as a good night's sleep from Medicine Curtains, and the representing curtains as providing additional status and development were stressed initially. Subsequently, messages focused more on logistics and compliance issues such as the process for obtaining curtains, redipping, correct use, and noticing the dead mosquitoes around the house.

Once distribution of curtains for work was completed, the project shifted its mobilization efforts towards encouraging independent adopters to bring their own cloth for dipping. Drama groups which had been started for AIDS prevention were supported to spread malaria prevention and curtain adoption messages throughout all 56 villages in the Child Survival area. While this led to increased knowledge about malaria and increased practice of other prevention behaviors, it did not particularly lead to curtain adoption.

3. REDIPPING AND PERMETHRIN REVOLVING FUNDS

While the first dipping with new curtains was free, it was made clear throughout that subsequent dipping would be paid for by the beneficiaries. The redipping price was set at US\$ 1.00 (MK15.00) for simple houses with doors and eaves, and US\$1.30 (MK20.00) for houses which also had windows. This covers the cost of replacing the permethrin from the overseas supplier since it was not available for a reasonable price within Malawi. The villagers themselves suggested the price differential and it seemed to be widely accepted.

For the first redipping in June/July, 1996, malaria helpers collected the money and assisted with the redipping since community systems were not yet established. Villagers had suggested that they might prepay for the Dec./Jan. redipping at the same time since they had money at the time of the first redipping, but knew they wouldn't by the time of the second. While accounting systems for prepayment were set up,

no one prepaid. It later came out that this was perhaps due to misunderstanding regarding money management, since villagers thought SC/US was collecting the money to recoup the cost of the curtains and they didn't realize it was to replace the permethrin being used. By the second redipping, permethrin was advanced to the health committees with the understanding that they would manage the redipping session, collect the money, and use that money to replace the advanced permethrin. This was done, and it was more clear that the money collected was staying in the control of the village. However, participation and payment were lower because it was pre-harvest season and the lean time of year.

The establishment of permethrin revolving funds managed by the health committees provide the means for permethrin to be distributed beyond the end of the project. These follow on a similar model of drug revolving funds developed under the Child Survival project where village volunteers and the village health committees are responsible for product distribution, money collection, accounting, and replenishment through SC/US. While the replenishment of the drug revolving funds will fall to the Ministry of Health, it is expected that SC/US will continue to assist with permethrin replenishment until a reliable supply of permethrin is available within the country. By the end of the project, there were still eight successful permethrin revolving funds, managed jointly by the malaria helpers and the health committees. However, all eight had diminished their base capital by more than 50% through the extension of credit during the last (lean) redipping session. By the end of the project, the committees were in the process of recouping that credit, and MK 2075 out of MK 6040 (US\$137 / US\$402) had been recovered. None of the villages had recouped 75% or more of their fund so that the long term health of their funds at the end of the project was questionable.

4. TRAINING

Training primarily targeted the SC/US staff and village volunteers who carried out this project. The eight malaria helpers and eight respective HSAs were trained for an initial 5 days. This training covered basic malaria education and prevention material such as causes, prevention, and management including the importance of early and appropriate treatment. The importance of considering diarrhea and respiratory rate were also introduced as part of the integrated management approach. During the last three days of the five day training the malaria helpers and HSAs were joined by an additional 28 enumerators for training in administering the KAP baseline survey. This training included the purpose of the project, a review of the questionnaire, and practical experience testing the questionnaire in a neighboring village. Similar enumerator refresher training for one to two days was provided for each subsequent survey. Additional training in community mobilization and support for drama groups was also included as part of the refresher training. Lastly, the drama groups were trained in message and show development around malaria in order to incorporate malaria messages as well as the concept of ad hoc show development into their repertoire of AIDS prevention.

5. DATA COLLECTION

Data collection formed a significant part of the project work load given the frequency of the KAP surveys. The data collection team included the malaria helpers, HSAs, and specially recruited enumerators for the surveys. These enumerators often included the VHPs and literacy instructors who were working with the Child Survival project as well as other literate and motivated people in their respective villages. This team collected KAP survey data, blood slides for parasitemia levels, and (for the final survey) hemoglobin levels. An entomologist was also contracted to do a permethrin knock down study comparing mosquito levels in curtains, non-curtains, and control houses at the end of the study. The specific schedule and types of data collected have already been covered under the Study Design part of this section.

D. BUDGET

The overall expenditure for this project was slightly over the projected budget. However, the variation in actual expenditures by cost center relative to the original projections is more significant. The biggest variation was due to a significant increase in the cost of cloth from the time the budget was prepared. This was mostly because the economic situation was unstable at the time the proposal was written and many of the prices in the market had not adjusted to the Kwacha devaluation. As a result of this miscalculation, the overall cost for project supplies was nearly double that which was originally budgeted. The cost of the

surveys and data collection, particularly since blood smears were added during the design of the project, was also higher than expected. This "over expenditure" was somewhat compensated for through the effectiveness and efficiency of the consultant who was hired as well as the use of technical assistance provided through the AID Mission. This meant the money budgeted for consultant assistance was more than was actually spent. Lastly, the malaria project had to pick up the salaries of the eight HSAs responsible for the intervention villages during the last nine months of the project because the hand over to the Ministry of Health did not go as planned. They were felt essential to assure the correct data collection and monitoring during the last phase of the project.

IV. PROJECT RESULTS

A. POPULATION PROFILE

As indicated in the study design section, the project targeted eight intervention villages and designated four additional villages as controls. These were purposively selected, and the following table summarizes their characteristics. Villages 9-12 are the control villages while villages 1-8 are the intervention villages.

Table 2 –Village Level – Descriptive Population Data

Village	Population	U5 yrs. children	#house holds	SES Level	Malaria Level	Water/ Drug Revolving fund
1-Mwatakata	1150	198	251	lower	higher	y/n
2-Matenje	1240	217	282	lower	lower	y/n
3-Nikisi	1031	157	237	higher	higher	y/n
4-Chalenga	1313	226	243	lower	higher	n/y
5-Mitawa Midondo	1219	195	231	higher	higher	y/y
6-Naunje	787	162	157	lower	higher	n/y
7-Mtendere	837	138	148	higher	higher	y/y
8-Mkaweya	1095	211	224	lower	lower	y/n
9- Chocho	638	142	154	lower	lower	y/n
10- Nasaluma	691	118	135	lower	higher	y/n
11- Ngunga	690	112	144	higher	lower	y/n
12- Mlongoti	1033	184	263	higher	higher	y/y

At the individual level, the overriding characteristic of the project population is poverty. Since this project depended upon people's ability and willingness to pay – both to obtain curtains for those not receiving the initial curtains for work input, and for those with curtains to redip them every six months, this has a significant impact on the acceptability of the intervention. People with so little disposable income can't afford to redip their curtains, much less purchase the cloth for new curtains even if they are convinced it is a useful intervention.

Possession of at least one of a radio, bicycle, sheep, goat, pig, cow or metal roof were considered for determining socio-economic status (SES). Overall, 21% of the population had none of these possessions, and 47% had one. The most common possessions were a radio, a bicycle, and (less often) a goat.

Estimates regarding village SES levels for categorization and matching of the control with the intervention groups were made based on staff familiarity with the impact area since other data were not available at the time. However, it turned out that intervention villages had 43% with zero or one possessions while the control villages had 54% in the same category. This difference was statistically significant with a Chi Square of 19.

Baseline data indicated overall that people were actively taking measures to control mosquitoes and/or prevent malaria. Over 96% of those surveyed claimed to practice one or more preventive sanitation behaviors, while 62% practiced one or more traditional mosquito control methods and 17% practiced commercial methods. Only 2.4% had ever used mosquito nets.

B. PARTICIPANT SATISFACTION

It was quite clear from all sources of information that consumer satisfaction with the curtains was very high. People appreciated the decrease in numbers of mosquitoes around their houses and reported seeing dead ones on the floor. They liked the curtains and felt they made the village look good "like a demonstration village". The distributed fabric was all the same, so was readily identifiable as part of the project. This led to villages applying social pressure on people to keep the curtains hanging in the houses rather than shifting to wearing them as skirts.

Tables 3 shows a comparison between adopters and non-adopters in knowledge, perceptions, and satisfaction as measured by mosquitoes in the household, and complaints about mosquito bites and malaria attacks. While knowledge scores are significantly higher among adopters, the majority of respondents in both categories reported that Medicine Curtains kill mosquitoes and reduce the number of malaria attacks. Thus, the perceived efficacy of curtains is high among all villagers. The reported decrease of mosquitoes and related variables in the adopter households is consistent with data from both the focus groups and the key informants.

The Chi Squares and Odds Ratios for the adopters as compared to the non-adopters were all significant.

Table 3: Comparison of Knowledge/Perceived Efficacy between Adopters and Non-Adopters Time 2 & Time 3.

	TIME 2				TIME 3			
	Adopters	Non-Adopters	Chi -sq.(Sig.)	OR(CI)	Adopters	Non-Adopters	Chi -sq. (Sig.)	OR(CI)
Have you received malaria HE?								
Yes	678(97.6)	784(91.8)	23.9***	2.37(1.5,3.6)	627(92.5)	523(62.9%)	179.72***	3.8(2.9,4.9)
No	17(2.4)	70(8.2)			51(7.5)	308(37.1)		
Do Medicine Curtains kill mosquitoes?								
Yes	677(98.7)	727(96.2)	8.9**	2.0 (1.1,3.6)	650(97.9)	513(94.3)	10.74+	1.79(1.2,2.8)
No	9(1.3)	29(3.8)			14(2.1)	31 (5.7)		
Do Medicine Curtains reduce mal attacks?								
Yes	678(98.8)	602(82.8)	106.3***	8.8(4.5,17.3)	655(98.2)	426(87.5)	54.65***	3.86(2.2,6.2)
No	8(1.2)	125(17.2)			12(1.8)	61(12.5)		
Have you noticed fewer mosquitoes in your house last 6 mos.?								
Yes	655(97.3)	91(12.5)	1010.77**	31.9(20.2,50.4)	663(96.4)	63(7.8)	1168.9***	
No	18(2.7)	637(97.5)			25(3.6)	747(92.2)		
In your HH was there less malaria among family members last 6 mos.?								
Yes	650(96.6)	114(15.0)	953.48***	24.7(16.5,36.9)	659(95.8)	49(6.0)	1203.8***	25.4(17.7,36.3)
No	23(3.4)	645(85.8)			29(4.2)	763(94.0)		

** P< .01

*** P< .001

Lastly, the project surveyed the perceptions of non-adopters with regards to their reasons for not having curtains and whether they would be interested. These results are shown in Table 4.

Table 4 - Perceptions of Non-Adopters Times 2 and 3

	Time 2		Time 3	
	n	%	N	%
Why did you not get curtains?				
Too much money	35	6.3	127	18.4
Too hard to get	264	47.6	394	56.0
Too much work	231	41.6	142	16.4
Don't want to cover eaves	4	.7	8	1.2
Mosquitoes not a problem	1	.2	1	.1
Have not heard about it	20	3.6	20	2.9
Other				
Do they plan to get Medicine Curtains?				
Yes	656	85.4	744	86.1
No	74	9.4	83	9.9
Maybe	23	2.9	30	3.6
Don't know	34	4.3	4	.5

C. BELIEF AND BEHAVIOR CHANGE

When considering change in beliefs and behavior due to the project, differences between the intervention and the control groups as well as changes between Time 1 and Time 4 were assessed. Both groups showed significant shift towards a Western model in their beliefs about the causes of malaria and whether there was anything they could do to prevent it. However, the intervention group showed significantly more preventive behavior adoption than the control group. For example, use of preventive sanitation and traditional mosquito prevention methods in addition to curtain adoption. This is consistent with a behavioral model where even if people have the knowledge, they are not likely to adopt a new behavior without a specific intervention or some other motivational factor.

Within the intervention group, a variety of variables were assessed to determine the level of their influence on behavior. They were looked at categorically by whether a belief or condition was present or not and whether each was significantly different between groups. Table 5 shows that most of the variable differences were slightly significant between groups.

Table 5: Village and individual characteristics of households who adopt /do not adopt Medicine Curtains(N=1565) in 8 intervention villages (Time 3)

Categorical independent variables	Do not adopt MC		Adopt MC		V. (sig.)	Chi square
	n	%	n	%		
Malaria level (Village)						
low	35%		147	24%	27.874(p < .001)	
high	1190	64%	465	76%		
Mosquitoes a problem (T3)						
yes	546	85%	175	30.2%	378.3 (p<.0000)	
no	96	15%	404	69.8%		
Can control mosquitoes(T3)						
yes	570	92%	533	93%	.26(NS)	
no	48	7.8%	40	7.0%		
Mosquito control important						
yes	625	98.9%	546	96.1%	9.7(p< .002)	
no	7	1.1%	22	3.9%		

Table 6 shows the change in beliefs and attitudes between Time 1 and Time 3 among the adopters and the non-adopters within the intervention group. People who adopted curtains showed more of a change in beliefs about disease causation and their ability to do something about it. They also decreased their use of traditional practices for mosquito control while those without Medicine Curtains maintained them. This may have been a compensatory behavior given the high profile malaria prevention activities had in the intervention villages. There was no significant change in preventive sanitation behaviors between the adopters and the non-adopters over time. Those with Medicine Curtains were of higher SES than those without.

Table 6 : Characteristics of individual householders who adopt /do not adopt Medicine Curtains (N=1565) in 8 intervention villages

Continuous Independent variables	Do not adopt MC Mean (SD)	Adopt MC Mean(SD)	F score (sig.)
Change- T1-3 Beliefs about Disease Causation	-.69 (.81)	-.82(85)	5.69 (P<.05)
Change-T13-Beliefs about causes of malaria	-.02 (1.05)	.07(1.21)	2.01(NS)
Change-T13 -Barriers to Malaria Prevention	.04 (.57)	-.29(.67)	87.25(p<.0001)
Change-T13-Traditional Mosquito Control	-.65 (1.6)	-1.13(1.58)	23.75(p<.001)
Change T13 - Preventive sanitation	.93 (1.93)	.83(1.40)	.91 (NS)
Change T13 - Commercial prevention	-.10(.59)	-.26(.72)	16.98(p<.001)
SES Level(Individual)	2.2(1.24)	2.8(1.48)	45.30(p<.001)

When logistic regression was done using multivariate analysis (as contrasted to the bivariate analysis represented in Tables 5 & 6) it appeared the SES and existing malaria levels in the village were the overriding determinants of preventive behavior. These structural factors in the village had more significance than the belief and behavioral factors also assessed. This is represented in Table 7.

Table 7: Logistic regression :Predictors of Adoption of Medicine Curtains and redipping of Medicine Curtains: Odds Ratios(Confidence Intervals) (Time 1 and Time 3)

	ANYMC(1=335:0=299)	REDIP (1= 192: 0=109)
Change barriers	.34 (.22, .52)	.67(.44, 1.01)
Change Beliefs about Disease	-----	-----
Change Beliefs about Malaria	-----	-----
Change Preventive Sanitation	-----	.85 (.71, 102)
Change Traditional Prevention	.83(.72, .99)	-----
Change Commercial Prevention	-----	1.42 (1.00,2.02)
Mosquitoes are a Problem (T 1)	-----	-----
Mosquitoes are a Problem (T 3)	.26 (.20, .34)	-----
Mosquito Contr Important (T1)	-----	-----

Mosquito Contr Important(T3)	-----	-----
Mosquito Prev Possible (T1)	-----	-----
Mosquito Prev possib'e (T3)	-----	-----
Socioeconomic status(ind)	1.61(1.34, 1.91)	1.51(1.21,1.87)
Malaria level(village)	2.24 (1.62, 3.11)	1.83 (1.31, 2.56)
Model Chi Square	237.57***	30.58***
Percent classified correctly	77.5%	66.8%

In spite of the satisfaction levels, redipping rates dropped off significantly as time went on. It should be stressed that dipping was totally unsubsidized and with relatively little program support since sustainability and chance for long term follow through were key issues considered by this project. There were reasonably good rates for the first redipping. This took place in June/July, 1996 when there had been a good harvest and people had disposable income. Rates dropped off for the second redipping. This took place in December/January, 1997 when people were waiting to harvest and there was a shortage of available cash. Of those who dipped, only 20% paid cash, with the rest taking credit from the health committee. This means only 10% of the original adopters actually paid cash for the second redipping. Overall, 76% redipped curtains for first time, which dropped to 53% the second time in spite of most people receiving credit for the second round of dipping. These rates are shown in Table 8.

Table 8 – Redipping rates by curtains for work adopters and independent adopters

CATEGORY	ORIGINAL	1 ST REDIPPING		2 ND REDIPPING	
	NUMBER	Number	%	Number	%
CURTAINS FOR WORK ADOPTERS	740	561	76%	390	53%
INDEPENDENT ADOPTERS	208	0	0	0	0

It is also significant to note that none of the independent adopters were from the intervention villages and none redipped their curtains at all. The malaria workers felt this was because they had originally brought their cloth with the hope of convincing SC/US that the curtains for work project should be extended to their villages due to their interest and motivation. When the extension of the curtains for work was not forthcoming, the “curtains” were put back to their original use which was probably as a skirt for the women.

Analyses were also done using the same characteristics to assess likelihood of redipping curtains within the intervention group. Unlike the comparison between adopters and non-adopters, there were no differences between redippers and those who did not redip with respect to most of the village characteristics with the exception of the belief that controlling malaria is important. This was significant. (Table 9)

Table 9: Village and individual characteristics of households who have dipped/not redipped medicine curtains at Time 4 (N=1565) in 8 intervention villages.

Categorical independent variables	Do Not Redip MC		Redip MC		Chi Square (sig)
	N	%	N	%	
Malaria level (village)					
Low	195	72%	235	75.6%	NS
High	75	27.8%	76	24.4%	
Mosquitos a problem T3					
Yes	87	32%	88	28.3%	NS
No	181	68%	233	71.7%	
Can control mosquitos					
Yes	245	92.8%	288	93.2%	NS
No	19	7.2%	21	6.8%	
Mosquito control important					
Yes	246	93.9%	300	98%	6.51 (P<.001)
No	16	6.1%	6	2.0%	

The level of poverty seems to be the underlying factor influencing all the curtains behaviors. While the project had assumed that cloth would somehow be found if the motivation were there, it appears that this was not the case. Every last scrap of cloth is worn as clothes until it falls off, and there is not extra, old cloth lying around these houses. As a result, a similar high capital outlay to obtain curtains is necessary for independent adopters as it was for the project. No matter how interested, this money is not available within such poor households. Likewise with respect to redipping, when money was available, people were interested in redipping their curtains and the US\$1.00 was reasonable enough to accept. However, during the lean time of year not even this was available. As a result, unless ways to make payment for redipping during the harvest season can be found – either through annual dipping with a different chemical or through a prepayment system, it is unlikely that the village will be able to support regular redipping either.

D. EFFICACY

The measures for efficacy included parasitemia levels for intervention villages at all four data collection points and for control villages at baseline and final, anemia levels taken for intervention and control villages at final data collection, and a permethrin knock down mosquito count in curtains, non-curtains, and control households at the end of the project. The presence of fever in the previous two weeks was ascertained with each survey, but this information was very inconsistent and not useful.

1. PARASITEMIA LEVELS

With respect to parasitemia, the levels were significantly higher during Times 2 & 4 due to rainy season, while lower during Times 1 & 3. This was to be expected. Differences between intervention and control villages in Time 1 were insignificant, while they were minimally significant in the unpredicted direction for Time 4. (Table 10) Anything greater than zero was considered positive. This was still the case when a log transformation to normalize the distribution was done on the data and when Analysis of Variance was done to control for SES and endemic malaria levels.

Table 10: Differences in parasitemia rates between treatment and control villages at baseline and Time 4

	Treatment		Control		Chi Square (sig)	OR (CI)
	N	%	N	%		
Positive – T1 October, 1995	36	9.5%	13	8.7%	.081 (NS)	
Positive – T2 April, 1997	212	24.9%	60	20.9%	2.477 (P<.10)	1.29 (.93, 1.78)

One would expect to have no difference at baseline. There are several possible explanations for the lack of apparent impact at Time 4:

1. The last rainy season was unusually heavy with a high incidence of malaria. As a result, biting patterns were probably different and the larger numbers of mosquitos may have led to significantly more biting before bedtime -- which is exposure the curtains cannot control.
2. The season was also particularly hot -- which may have led to people staying up and outside later and therefore also being more exposed.
3. Compliance with redipping had dropped due to lack of available cash during pre-harvest season, although there was not difference in parasitemia levels between those who redipped and those who did not. Compliance in use may also not have been as consistent with the passage of time. This was only measured by self report to the malaria helpers in each village. Since all knew what the project was looking for, it is hard to be sure the report represents reality.

The above explanations are consistent with an earlier finding that there was a significant difference in parasitemia levels between intervention and control groups at Time 2 (the previous rainy season). Rainy season in 1996 was good but not extreme, temperatures were not as hot, and it was earlier in the project so compliance may also have been better.

Table 11: Differences in parasitemia levels (Mean parasite density) among under fives between Medicine Curtains adopters and non-adopters – T1, T2, and T3

	MC Adopters	MC non-adopters	F Score	Significance
	Mean (SD)/ Median	Mean(SD)/ Median		
TIME 1	161.899 139.00 N=18	161.250 (84.6) 368.5 N=12	.000	NS
TIME 2	1416.46 (604.98) 1568.00 N=13	1919.62 (594.6) 1823.00 N=39	6.923	P<.01
TIME 3	43 (105.85) N=6	162.5 (118.4) N=4	.070	NS

Note: There was one case with over 10,000 parasite density in the non-adopters category

2. HEMOGLOBIN LEVELS

Unfortunately, hemoglobin levels were only measured during the final data collection due to technical difficulties earlier in the project. However, these did show quite significant differences between the intervention and control villages as well as some significance between curtains adopters and non-adopters within the intervention villages. There was no difference between those that had redipped and those that did not.

These results lead the researchers to think that hemoglobin levels may be a more chronic indicator of malaria exposure over time while the parasitemia levels indicate more acute infections influenced by the immediate season. This has significant implications for this as an adjunct intervention to those for anemia as well as those for malaria.

Table 12 shows the difference in mean Hemoglobin level between treatment and control villages. "Normal" hemoglobin levels are far below the desired level throughout the research area, to this was treated as a continuous variable rather than trying to establish a categorical cut-off for defining anemia. Again, the results were the same when Analysis of Variance was done to control for SES and endemic malaria level.

Table 12: Differences in anemia-rates among under fives between Medicine Curtains adopters, non-adopters and control villages – Time 4 (Total N = 272)

Treatment Condition	Mean/(SD)	T score (equal variance assumed)	Significance
Control Villages	7.72 (.16)	4.65	P<.0001
Intervention Villages	8.94 (.19)		
Intervention Villages			P<.10
MC Adopters	9.16 (.19)	-1.73	
MC Non-adopters	8.59 (.28)		
Adopters			
Redipped MC	9.22 (.22)	.626	NS
Did not redip MC	8.91 (.30)		

3. ENTOMOLOGY

A Permethrin Knock Down study was carried out at the end of the project to assess mosquito levels in control, adopter, and non-adopter households. Unfortunately, this was not also carried out earlier due to difficulty finding qualified, available people in the country to do it. There were no significant differences in mosquito levels between any of the three categories of households. There are several possible explanations for this finding:

1. the overall sample was small with 13 households in each category,
2. the assessment was carried out after the rainy season and after the cold had begun to set in. As a result, there were few mosquitos anywhere and it was difficult to find enough mosquitos to make the assessment valid and
3. the possibility that compliance was decreasing both in redipping and use would lead to no change in household mosquito levels.

V. CONCLUSIONS AND RECOMMENDATIONS

The issues and lessons arising from this project can be grouped in several categories:

1. mobilization and adoption,
2. correct use and redipping,
3. efficacy, and
4. logistics.

A. MOBILIZATION AND ADOPTION

- Malaria is a severe health problem and people spend money and effort to control mosquitoes. This is shown by the behaviors ranging from sanitation to traditional and commercial mosquito control methods which were mentioned during both the focus groups and the surveys as well as the overall priority given to malaria control during the focus groups.
- Effectiveness in mosquito control is much more a factor for encouraging adoption of curtains than is impact on malaria. This is probably because people can see, feel and touch the control rather than just believe it is happening.
- The original assumption that convinced potential adopters would be able to find cloth for dipping as curtains within the household was wrong. The people in the project area are extremely poor, and there was Nothing extra around their houses. All cloth is worn until it dissolves.

208 independent adopters who initially brought their own cloth for dipping would appear to discount this. However, none of those brought their cloth for redipping and malaria helpers indicated they might

have brought cloth initially with the hope they would convince SC/US to bring curtains for work to their villages. When this was not forthcoming, they put the cloth back to its original use.

- There was definitely status associated with having curtains. They were attractive, effective and coveted. People who were too late for curtains for work felt left out and resented that they had not also received curtains.
- The cost of anti-malarials is insignificant relative to the cost of curtains. The capital outlay for curtains was about US\$28, while a treatment dose of SP was US\$0.35. Given a village mentality that does not think either in terms of insurance (against mortality) , or the cost of days of work lost, relative cost is not a useful approach for encouraging adoption.
- Cost was by far the chief barrier to obtaining and even maintaining curtains. No one was able to afford curtains without subsidy, and the timing of redipping relative to harvest and available cash was also the key determinant for redipping.
- The dependence of this intervention on available cash, both for procurement and redipping of curtains, may make it impractical and unsustainable in rural areas where subsistence agriculture is the norm. There might be more success in areas that depend more on a cash economy.
- The existing trust relationship already established with Save the Children staff in the area through the Child Survival and Education programs was a significant asset in the mobilization of villages for Medicine Curtains.

B. APPROPRIATE USE AND REDIPPING

- Twice a year dipping as required for permethrin means that redipping will inevitably fall at times of the year that people don't have money. This in turn becomes the key barrier to people maintaining the strength of their curtains. This is the likely explanation for the drop off in people redipping during the second redipping cycle.
- Durability and correct installation and use of the curtains were not particularly issues.
- The full, unsubsidized cost of redipping IS affordable, even in a rural economy, when people see the value and if payment can be coordinated with times when money is available.
- Social pressure was a positive factor encouraging people to keep their curtains in their houses and not use the cloth for other purposes. The consistency of the cloth used for the project made recognition easy and facilitated this pressure.
- Notifying people in advance that they would be expected to pay for all subsequent dipping allowed them to get prepared psychologically as well as to plan for that expenditure.
- The visible, concrete results represented by dead mosquitoes on the floor made great reinforcement for health education and mobilization efforts. The challenge is to maintain the behavior of redipping for the long term without continued education and mobilization efforts.

C. EFFICACY

- Hemoglobin levels, rather than parasitemia levels may be a better long term indicator for measuring the impact of impregnated curtains on child health.
- Over the long term, impregnated curtains appear to positively affect hemoglobin levels in children under five.
- During a season with particularly high mosquito prevalence and malaria incidence, impregnated curtains may not be effective in malaria control due to the high biting rate, and therefore exposure, occurring at times other than when people are in their houses. They may be more effective when biting levels are such that outdoor exposure is limited.
- People's sleeping also significantly influence the effectiveness of an interventions such as this due to variation in outdoor exposure time.
- While impregnated curtains are probably not adequate as a stand alone intervention for malaria control, there appears to be added benefit which could potentiate other malaria control or anemia treatment interventions.

D. LOGISTICS

- While logistics for curtain distribution and redipping are a considerable challenge, they are possible. As a demonstration project, this project showed that impregnated curtains were a low technology intervention that could be implemented at the village level. It appears that maintenance of the project can be possible with village resources and the redipping process lends itself to cost recovery mechanisms managed by the community. Limited assistance with procurement of permethrin will be necessary due to its lack of availability.
- Use of netting for covering the eaves was probably an unnecessary luxury. The cloth was more expensive and less durable while the benefit of increased air circulation is dubious.
- The project structure enhancing the Child Survival project and using malaria helpers to manage the initial installation and organization at the village level worked well. The project benefited from the credibility and broader scope of the Child Survival project, while having malaria helpers dedicated to the malaria project helped raise the profile and establish momentum.
- All money transactions need to be completely transparent with multiple people accountable. Misunderstanding over what was happening with the first cycle redipping money led to delayed redipping and unwillingness to prepay the next cycle even though people had the money. As control of the money is left transparently in the hands of several villagers, the likelihood of their adopting the management of the redipping and ongoing maintenance increases.
- This was a complicated and difficult study to carry out in an area such as rural Malawi. The lack of technical resources within the country and monetary resources for outside assistance, as well as the initial emphasis on behavioral rather than efficacy indicators led to gaps in data which make strong efficacy conclusions difficult. Specifically these gaps include information on the actual number of malaria attacks and number of treatments received, information on actual curtain use and sleeping habits, and the baseline and longitudinal data on hemoglobin and residual mosquito levels.

E. RECOMMENDATIONS

- This intervention will likely be more successful if it targets people who have a somewhat regular cash flow and are part of the cash economy. Experimenting with a more urban setting should be a next step in pursuing this intervention.
- Regardless of whether this is adopted as a project intervention, low cost dipping with malaria insecticides should be made available on a widespread basis for those who can afford the curtains and redipping costs. Such an intervention can impact health over time, and may decrease the reservoir even if it is not affordable among the most poor people.
- Where income is irregular, dipping – or at least payment for dipping – should be scheduled for times of the year when people have available cash. This can either be done through adoption of a chemical that only needs to be applied once a year and/or setting up systems for pre-payment during the times when users do have cash available. The effective duration of dipping with a given chemical should also be carefully assessed to avoid requiring more frequent dipping than necessary.
- Ways to encourage the maintenance of redipping and curtain use over time without continuous education and mobilization messages need to be explored if this intervention will support long term behavior change.
- Further work needs to be done to document impact of this intervention on malaria and anemia with consideration for seasonality and variations in malaria prevalence due to variations in rainfall. More longitudinal data collection of hemoglobin and mosquito levels, sleeping habits, and attack rates needs to be done.
- The high cost of cloth raises the question whether there aren't locally available materials that could be made into something that could be dipped and installed in houses. These might include palm mats, or something with straw.

VI. SUSTAINABILITY / FUTURE PLANS

Maintaining the permethrin revolving funds, exploring alternative dipping cycles and/or materials to better coincide with people's available cash, and finding populations with a little more disposable income to support the intervention are directions this project hopes to follow in the future. It also needs to reconsider the impact issues.

A. PERMETHRIN REVOLVING FUNDS

In Chilipa, the permethrin revolving funds (PRF) are functioning along side drug revolving funds for essential drugs which were established under the Child Survival project. Committees and VHPs have been trained in fund management. While the drug funds are continuing to maintain themselves, the last year with its poor harvest has negatively impacted the base capital in the permethrin funds. Starting with its Child Survival program in the north, SC/US has shown that revolving funds, at least with drugs, can be a viable cost recovery mechanism that is sustainable. If a product is valued by the village they can manage the fund collection and record keeping to support its sale. Transparency in accounting, both for the product and for the cash is essential, and involvement of more than one village person in all aspects of management also assists with maintaining the integrity of the fund. In the case of the PRFs, the role of the malaria helper has been instrumental up to this point, and these people will be encouraged to continue their involvement in spite of the project's ending. This is thought possible because they are from the villages themselves, have been involved with other child survival activities, and were selected based on their high level of involvement with community activities.

Although the MOH has shown some interest in supplying permethrin in the future, at this time there is not an affordable supply of it available in the country. This is a serious constraint for sustaining any impregnated materials intervention. The agency will continue to advocate for the easy availability of permethrin within the country, while continuing to assist with permethrin procurement and distribution to the PRFs in areas where it has ongoing projects until other options become available.

The need for the PRFs to extend credit during the December/January redipping was problematic for long term sustainability of the funds since recovery is difficult. While it is up to the committees, in the future SC/US is recommending that a pre-payment mechanism be set up immediately after the harvest that will cover the lean season dipping. This will depend on the extent to which the people trust the fund management, but the money collected could be immediately turned into permethrin, and the village would then be set for the rest of the year. If the country were to move towards making one of the chemicals such as Deltamethrin, which needs to be applied less frequently, available this would be another solution to covering the lean time. This is of particular concern because the lean time is also the time of highest malaria incidence.

As the project has seen, there was a drop off in redipping and appears to also have been a drop off in consistent use. It is a challenge to maintain a new behavior (i.e. dipping curtains) without ongoing reinforcement. It is hoped that the continued presence of SC/US, the impact of the community centered dipping sessions, and the reinforcement of dead mosquitoes will all help overcome the tendency for the behavior to drop off before it becomes well established.

B. EXPANSION

Towards the end of the current project, SC/US began experimenting with marketing Medicine Curtains through primary schools near to Mangochi Boma. The expectation was that these drew from an area where there was more cash, that parents were perhaps a little more aware, and that more houses had curtains already in place. In addition, because these schools are sponsorship schools, SC/US will be able to continue to support such an effort even after the project funds are finished. Parent / Teacher groups were convened and educated about the benefits of Medicine Curtains. It was then suggested that they organize dipping for anyone around the school who might have curtains they would want to dip. They could do this on a cost

plus basis such that they could replenish the permethrin (through SC/US) and have a little money left over as income generation for the school. It is still too early in this effort to report on progress.