



# **ACTION PLAN FOR SCALING UP LONG LASTING INSECTICIDAL NETS FOR MALARIA CONTROL IN INDIA**

**(2009)**



**Government of India**

**Directorate of National Vector Borne Disease Control Programme  
Directorate General of Health Services  
Ministry of Health and Family Welfare**

## **1. Background**

The effective control of malaria control relies principally on efficient interventions for prevention and case management. Vector control interventions reduce transmission and thus decrease the incidence of malaria. Long lasting insecticidal net (LLIN) is a key vector control intervention for protection of populations at risk of malaria. The LLINs provide protection with the net as well as the insecticide. The WHO endorses the approach of scaled up distribution of LLIN, at no cost to the end-users, and recommends that 100% coverage of the targeted population is achieved to exploit the community protective effect of LLINs.

The scaling up of LLINs is one of the most important strategies of the National Vector Borne Disease Control Programme (NVBDCP) towards control of malaria. The LLIN is a factory pre-treated mosquito net which retains its insecticidal activity even after 20 standard WHO washes and has a minimum life of 3 years when used under field conditions. The LLINs are generally more effective than conventional Insecticide Treated Nets (ITN), because they have an even and quality-controlled application of insecticides. They are also more cost-effective in the long term, as they do not require re-treatments like the conventional ITNs.

## **2. Objectives**

The main objective of scaling up use of LLINs is to achieve universal coverage and maximal utilization of LLIN by all populations living in high malaria endemic areas ( $API \geq 2$ ), with priority to areas having  $API \geq 5$ , in order to have a significant reduction in morbidity and mortality due to malaria.

### **2.1 Specific Objectives**

- To provide LLINs free of cost to people living in targeted areas to achieve at least 80% effective coverage by the year 2015
- To create awareness and stimulate regular and daily use of LLIN by populations by use of BCC strategy
- To ensure that only LLINs which meet the specifications approved by Government of India are provided to the users with a quality control mechanism well established
- To facilitate availability of LLINs through the private sector at affordable prices in urban areas
- To create effective partnerships with NGOs and private sector for scale up of LLIN use.
- To encourage enterprises for local production of LLIN in the country.

## **3. Planning**

Given the difficulties of maintaining high coverage and quality of IRS, it is expected that over a few years, ITNs, especially LLINs, will replace IRS in most areas, although the latter method will still be needed to combat epidemics and in areas where people can not easily be encouraged to use ITNs. LLIN may be the most appropriate vector control option in India as considerable amount of difficulty has been experienced in performing repeated net treatments.

Priority for provision of LLINs would be given those high-risk populations, which cannot be reached by IRS because of operational factors such as poor access, for example, those living in forest and forest-fringe areas. Many of these areas remain cut-off during the rainy season and use of LLINs is appropriate in these areas, as they can be delivered several months before transmission picks up. In forest-fringe villages, LLINs should be preferred to IRS for prevention of bites by the efficient vector mosquitoes in forests as

people may go for working in the forests and stay overnight there. The importance of carrying nets to the forests and using them should be highlighted.

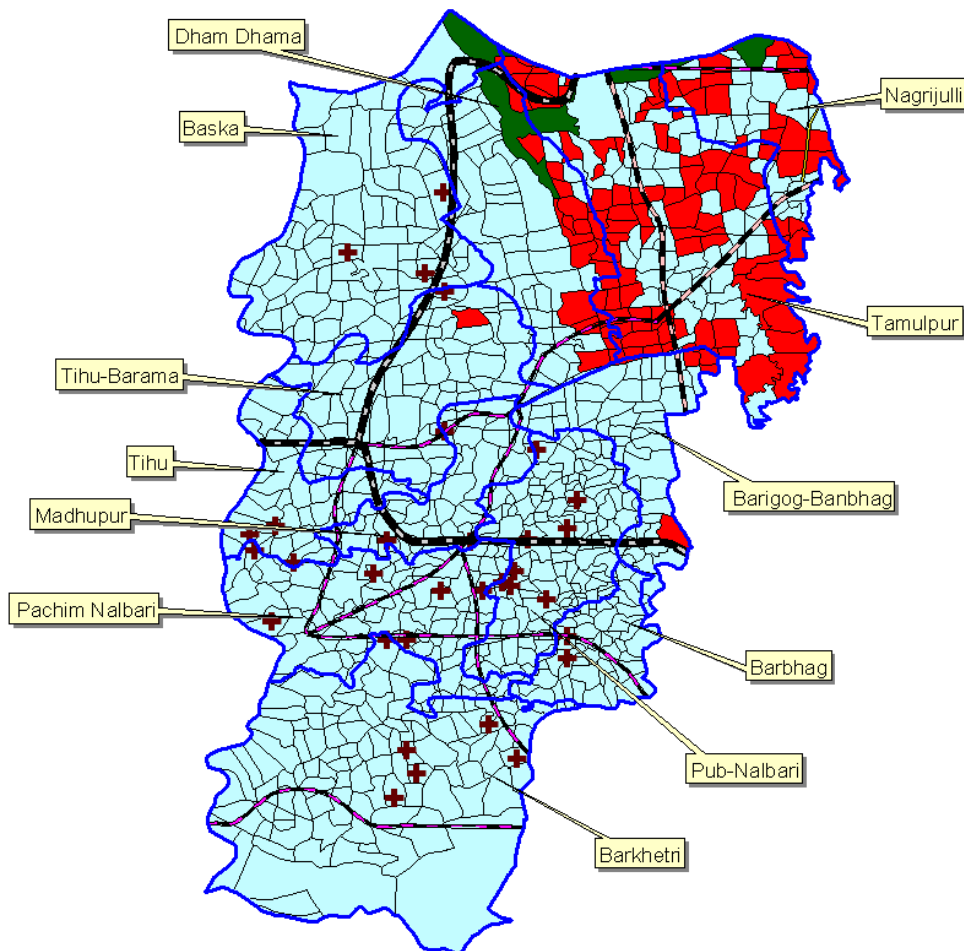
The VBDC staff at district level is responsible for identification and mapping of high risk areas for planning vector control. Target groups for distribution of LLIN are selected based on the epidemiological, entomological, ecological and geographic factors.

Due to limited availability of LLIN at present, the high risk population (those living in areas with API > 5) will be prioritized as follows:

- Phase 1. High risk population living in inaccessible, forest and forest fringe areas.
- Phase 2. High risk population living in relatively accessible plain areas with operational constraints for IRS use.
- Phase 3. All other high risk areas.

It is considered rational to classify whole subcentre areas with API  $\geq$  5 as high risk areas including all villages under the subcentre for providing 100% LLIN coverage. Although ITNs/LLINs provide protection to the individual using them, the full benefits to the community are obtained at high coverage levels.

A sample GIS map as shown below facilitates depiction of API stratified data at subcentre and village level, for planning scale up of LLIN coverage.



It is essential to distinguish between eligible populations and annual plan target populations for LLIN coverage. In the short term, monitoring is done to assess coverage of annual targeted populations. In the long term, monitoring of performance will be done for the entire eligible population. These long- and short-term evaluations are greatly facilitated by correct use of standardized planning formats.

In all high risk villages where ITNs are being used, these would be steadily be replaced by LLINs. As a general rule, if a village is targeted for LLIN, enough LLINs should be provided to cover the whole population of the village, even if some people own conventional bednets. It is expected that LLIN will become the main malaria vector control intervention in high-risk areas over the coming 5-10 years. Despite the advantages of LLIN, re-impregnation of bed nets, which are already with the population, is still useful till the time they get replaced by LLINs. Re-treatment of conventional bed nets in such villages will continue, particularly in those villages where a significant proportion of the community is using bed nets (say, during the transmission season), at least 30 % of the population answer “yes” to the question “Did you sleep under a mosquito net last night?”. It can be assumed that people in such villages will be encouraged by re-impregnation operations and BCC to acquire LLINs themselves, so that over time, coverage can be facilitated to reach 100%.

The pace at which LLINs are procured may not immediately allow coverage of all the entire eligible populations in the country. Staffing and operational logistics capacity may impose additional limitations in the scaling up. Therefore, it becomes imperative to prioritize the eligible population and to identify those populations which can be covered in a phase-wise manner and identify annual target populations. These must be planned under resource constraints giving highest priority to those populations with the highest risk (API levels are generally taken as a yardstick to measure levels of malaria risk).

The LLIN planning is done by the DMO in collaboration with the block and MO-PHCs concerned. The epidemiological data should be thoroughly analyzed in this process. A meeting of MO-PHCs must be convened by CMHO / DMO for this purpose, normally in the month of December. In some large districts, it may be necessary to convene such meetings for a cluster of blocks or even a single block. The population is obtained from the subcentre wise epidemiological data stratified by  $API \geq 5$ ,  $API 2 - 5$ , and less than 2. The figures of urban population which do not get covered by these groups should also be available at the district level. Planning will take into consideration the epidemiological data and other factors. The PHC level plans made by MO-PHCs may be modified after assessing the priorities and resources and then consolidated at block level, district level and state level. The planning should include information obtained from household surveys on ITN/LLINs available with the community.

The data must be prepared at district level as follows:

- List of all PHCs and blocks in the district
- List of all the sub-health centre areas within a PHC or block, targeted for LLIN distribution
- The size of the population, village-wise, of the entire subcentre area
- Representation of the sub-centre areas and their villages on a map

The framework for calculation of LLIN requirement at the state level will be made on the basis of the following table.

S. No.	Name of district	No. of PHCs	No. of subcentres	No. of households	Total population	High risk subcentres with API > 2					High risk subcentres with API > 5				
						No. of subcentres	No. of households	Total population	No of bednets required to saturate 80% of the API >2 population	No. of households already covered with LLINs	Total No. of sub-centres	Total No. of households	Total population	Total no of bednets required to saturate 80% of population in areas with API ≥ 5	No of households living in areas with API ≥ 5 which is already covered with LLINs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Unless full details are available, It can be assumed that an average household has 5 members (2 adults and 3 children). It is then possible for one LLIN to give coverage for an average 2.5 persons (2 adults / 1 adult plus 2 children / 3 children). Thus, for a given village, the number of LLIN to be provided is usually equal to the total population divided by 2.5. This formula is useful than household based formula of two nets per household, as many households may be of large size with more than 5 members in the house. However, distribution at household level may follow the schedule given below to assure 100% coverage with LLINs:

1 - 2 persons	-	1 LLIN
3 - 5 persons	-	2 LLINs
6 - 7 persons	-	3 LLINs
8 - 10 persons	-	4 LLINs

Sometimes, villagers may complain that the number of nets assessed by the above schedule is insufficient as many members sleep apart. It will not be possible to cater for such individual needs and such families will be asked to purchase additional LLINs from the market.

Generally, for a targeted village, the required number of LLIN should be distributed in one single operation. However, in rare circumstances, it can be considered to distribute one LLIN per household per year over a period of two years. The timing of LLIN distribution is less critical than the timing of IRS or re-treatment of nets. However, for educational as well as logistical reasons, distribution shortly before the start of the rainy season or transmission season is probably the best option.

In addition to distribution to targeted high-risk villages aiming at complete population coverage, an effort will be made by the states, from their own resources, to provide LLIN to pregnant women in high risk areas and to special groups such as children in tribal schools and hostels. These children should take the nets home with them during vacations.

#### 4. Procurement

Bids for supply of nets must be accompanied by a reference sample of the nets which will be supplied. This reference sample must be comprised of at least two nets, one to be tested by the purchaser and one to be stored as a reference in case of disputes. Producers must deliver a uniform consignment which conforms to the reference sample.

In terms of off-shore procurement, arrangements for the procurement and shipping of LLIN for public sector distribution will be made with recognized manufacturers, suppliers and distributors. This can be implemented in consultation between MOH&FW, World Bank, GFATM and other partners. The local manufacture of nets and insecticides is to be encouraged in the long-term, provided that minimum specifications are met.

Once the order is placed to the firm, a copy of the order is marked to the consignees (state/GMSD) to issue road permits and ensure the availability of space before delivery. The supply will be started by the firm on receipt of road permits. The state will issue Goods Receipt and Acceptance (GRAN) certificate to the supplier as well as to the procurement agency immediately to avoid any demurrage charges of the goods and document discrepancy if any.

The Final Acceptance Certificate (FAC) will be issued after detailed physical verification of the quantities, specifications, batch no., expiry date, delivery schedule and certificate of quality control test results in conformity with the standards as provided in the technical specifications. The details will be entered in the stock register with signature/verification report of the receiving authority with in one month time.

The district level supply will be made by the state as per the technical requirement of the districts and the action plan. The state should fill up the stock position statement by compiling the data received from Districts and submit it to the Directorate of NVBDCP, every quarter. They should also issue the quarterly consumption certificate and finally the annual consumption certificate with details like consumption, stock in hand, further requirement etc. If the state feels it necessary, they may randomly check the quality of the items as per the state's procedure by an independent, authorized testing laboratory and document the test reports. If any discrepancy is noticed, the Directorate will be informed immediately for further necessary action. LLINs for use in India must be recommended by WHO and registered by the Central Insecticide Board, India. The list of WHO recommended LLINs updated till August 2009 is as under.

Ser No	Product name	Product type	Status of WHO recommendation
1.	DawaPlus 2.0	Deltamethrin coated on polyester	Interim
2.	Duranet	Alpha-cypermethrin incorporated into polyethylene	Interim
3.	Interceptor	Alpha-cypermethrin coated on polyester	Interim
4.	Netprotect	Deltamethrin incorporated into polyethylene	Interim
5.	Olyset	Permethrin incorporated into polyethylene	Full
6.	Permanet 2.0	Deltamethrin coated on polyester	Full
7.	Permanet 2.5	Deltamethrin coated on polyester with strengthened border	Interim
8.	Permanet 3.0	Combination of Deltamethrin coated polyester with strengthened border (side panels) and Deltamethrin and PBO incorporated into polyethylene (roof)	Interim

While making polyethylene yarn for LLINs, the insecticide is mixed with the polymer used to make the yarn. As the net is washed, insecticide on the surface which may wear off is replaced by fresh insecticide emerging from the inside of the yarn. In polyester LLINs the insecticide is bound to the yarn by a chemical binder.

The type of bed nets that can be provided depends on the brands registered in India and the supply situation. NVBDCP will inform states about the expected effective life of the types of nets provided each year and any specific requirements.

## 5. Storage

The bales of LLIN are well packed and the individual LLINs are also wrapped in sealed plastic bags. Nevertheless, it is important to ensure that warehouses are clean, well-lit and well ventilated and the LLINs are not exposed to direct sunlight. The warehouse should be disinfected regularly and monitored to ensure that it is free from rodents, insects and termites. It should be ensured that the warehouse is free from water penetration or seepage from the walls, roof, doors and windows, especially during the rainy season. It should also be ensured that the fire extinguishers are available and accessible and that personnel are trained to use it. Fire proof electrical fittings and appliances will be installed and the stocks stored away from electrical sockets. The safety and security should be monitored to avoid theft and pilferage of LLINs.

The principal concern in storage of LLINs is that of their volume rather than weight. The very large volumes involved make it critical that there is adequate storage capacity at all levels. Even though in theory, 5.8 bales of polyester LLIN occupy a volume of 1 m<sup>3</sup>, in practice, 4 bales/m<sup>3</sup> is a reasonable working figure. Thus, if a warehouse is 10 m x 20 m in size with storage height of 3 m, the available volume is 600 m<sup>3</sup>, which would accommodate 600 x 4 = 2,400 bales or a total of 240,000 polyester LLIN. Polyethylene LLINs can be stored at 6 bales/m<sup>3</sup>, so that the warehouse volume of 600 m<sup>3</sup> would accommodate 3,600 bales or 144,000 LLIN of this type. The storage space can often be rented, but rental costs would have to be weighed against possibly greater cost of staggered delivery.

The cartons are stacked in steel racks/slotted angles and at least 10 cm (4 inches) off the floor; 30 cm (1 foot) away from the walls and other stacks and no more than 2.5 m (8 feet) high. The storage system should be in a way that passages are available in between the stacks for easy movement of personnel. They will be arranged such that identification labels, expiry dates, and manufacturing dates are visible. Stock management should be based on the "first in, first out" rule. The bales must be stacked in such a way as to create equal piles each identified by a bin card. The bales must be carefully counted by at least two individuals during off-loading of the containers. The stock quantities should be updated in the stock ledgers and files should be kept in safe custody.

## 6. Transportation

The characteristics of the polyester and polyethylene LLINs, relevant to logistics are shown in the table below.

**Table: Characteristics of LLIN relevant to logistics**

Characteristics	Multifilament polyester LLIN (deltamethrin-coated)	Monofilament polyethylene LLIN (permethrin-incorporated)
Weight per LLIN	440 g	625 g
No. of LLINs per bale	100	40
Weight per bale	42 kg	29 kg

Volume per bale	0.1727–0.1894 m <sup>3</sup>	0.127 m <sup>3</sup>
LLIN per 40-ft container	36,900	16,800

Although LLINs are usually individually wrapped and the bales robustly packaged, every vehicle used for their transportation must be equipped with tarpaulin covers for their protection. The volume is a main consideration during transportation of LLINs rather than their weight. A 8 ton truck can carry 140 bales of LLIN, if correctly loaded. The transportation of LLIN from district level to the CHC/PHC/subcentres at the periphery can be done by vehicles provided by the district authorities specifically for this purpose or through the vehicles normally used to carry medicines, vaccines and other supplies within the district. A 4 x 4 vehicle with mobile health team members with vaccine and other equipment can carry 150 LLIN weighing about 100 Kg. For populations residing in scattered hamlets, motor cycles and cycles may also be used as follows.

- Motorcycle - 10 LLINs weighing 6.5 kg, in addition to a vaccine carrier
- Bicycle - 4 – 6 LLIN weighing 2.6–4.0 kg, in addition to the vaccine carrier.

It should be ensured that there is adequate storage capacity and reliable transport facilities at all levels, as well as precise timing. The logistics plan must include a detailed budget for all transport and storage needs. Most importantly, logistic mechanisms must ensure adequate supervision and control of all operations and full accountability at every stage. It is worth remembering that LLINs have high potential for resale at various levels and if that is allowed to occur, that will have extremely deleterious effects on the image and performance of the programme.

## 7. Distribution

### 7.1 Preparatory activities

It is important that preparatory work is done to ensure optimal use of nets. Each year during the pre-transmission season a survey should be conducted to enumerate the following to determine the requirement of LLINs during the year:

- Number of households
- Number of persons in each household
- Number of plain mosquito nets/ LLIN in use
- Number of bednets to be impregnated

Once the survey is completed, the following will be done:

- Preparation of the list of beneficiaries
- Selection of site(s) for LLIN distribution
- Identification and involvement of community representatives, self help groups, women organizations and NGOs for LLIN distribution

### 7.2 Public Distribution

The LLINs will be provided free of charge through the public sector health care system to the all members living in the targeted villages. The distribution will be through public health facilities or at community level camps. The public sector is an effective delivery method, especially for reaching isolated rural populations



and other vulnerable groups. The public sector may also utilize the services of CBOs, NGOs, and FBOs. A capacity building component is required to improve the capacity of health staff at all levels, including community health volunteers for implementation of LLIN distribution. The distribution will involve the following:

- Organize camps for distribution of LLINs
- Keep records of mosquito net distribution using the prescribed formats
- Make arrangements for distribution to those who were unable to attend the camp(s)

Post-distribution activities include the following:

- Periodic visits must be made to check net use.
- In communities which did not previously have a habit of using nets, frequent communication by local health workers after distribution is essential.

### **7.3 Distribution through the Private Sector**

It is hoped that in the course of time, the quantity of LLIN delivered through the private sector will also increase which will address those populations which remain to be covered by the public health system, particularly the urban populations. The Government will perform an enabling role in private sector distribution and create an environment necessary for long term sustenance of the commercial sector in LLIN production.

## **8. Behaviour Change Communication**

BCC of the community will be carried out for the regular and proper care and use of the nets by use of

- Mass media, including national and local television and radio, newspapers
- Interpersonal communication, social mobilization, participatory communication at community level, focus group discussions, etc
- Faith Based Organizations (FBOs), NGOs, Community based organizations (CBOs), schools, women's groups, self help groups, community gatherings and theatre, etc.
- Commercial advertising and marketing techniques

Health workers at health facilities and community health volunteers will provide key information during one-to-one encounters, especially when treating patients with malaria, during antenatal care and immunization clinics. Talks will also be given in small groups to those waiting for health services with additional use of audio tapes and video films. Flipcharts, guidelines, leaflets and flash cards, should be prepared to support interpersonal communication. The materials produced should be sufficient to cover the entire target population. Volunteers involved in bednet/LLIN work should be able to demonstrate correct hanging and also use of nets outdoors with the help of four sticks. Posters and billboards will be displayed at vantage points in villages to announce LLIN distribution date and time.

The key messages that will be conveyed regarding LLINs are:

- LLINs and ITNs are safe for the users including pregnant women and young children. Direct skin contact with a wet net may cause a tingling sensation in some people but this is not harmful.
- Young children and pregnant women in the house should particularly use the net, because malaria is a more serious disease in them. However, all family members should be encouraged to use bed nets.
- The net may smell of the insecticide for a few days but this will subside and is harmless.

- The net will kill a variety of insects including mosquitoes which spread malaria.
- Use of these nets will allow the user to have undisturbed sleep due to avoidance of mosquito bites.
- The ITN/LLIN should be used every night, all year round, even if mosquitoes are not sighted or heard.
- If there is a need of any family member to go and sleep in a forest or outdoor, it is important for him/her to take the net along with and use it while sleeping. It should be highlighted that forest dwelling species of mosquitoes are more dangerous vectors in malaria transmission.
- The nets should be hung in such a way with the lower edges tucked under the bed preventing access for mosquitoes to enter inside.
- The nets should be washed when absolutely necessary, because every wash will remove some insecticide.
- LLINs are costly and very effective in prevention of malaria. Therefore, they should be kept with the household and used by the family, until they are replaced by new LLINs.
- During daytime, the nets can be folded up and hung over the sleeping place.
- Ordinary bed-nets need to be treated every six months.

## **9. Monitoring and Evaluation**

The LLIN distribution record will be maintained at the village and subcentre level for future reference and review by the supervisory teams visiting from various levels. The formats are as follows.

### **9.1 Primary record of bed net delivery and impregnation (VC - 3)**

The Primary record of bed net delivery and impregnation (VC3) is village level record of bednets available in the households and the details of house wise distribution and impregnation of nets. Prior to the onset of the transmission season, the MPW (M) with assistance from ASHA/ AWW will undertake a survey in villages of his sub-centre area to enumerate the number of nets available at the household level. The form gives details of impregnation and distribution of bed nets in the village, including house-wise details of requirement and availability of bednets. The format of VC – 3 is attached as appendix A.

### **9.2 Bednet Output Form (VC - 4)**

VC - 4 is a compilation of village, sub-centre, and PHC wise compilation of bed net impregnation and distribution activities. The village level VC - 3 should be submitted by MPW (M) to the PHC at the end of the bed net distribution and impregnation activities. As soon as the VC - 3 from a village is received, it should be entered in VC – 4 in duplicate. The VC - 4 would then be sent to the DMO within 15 days of completion of activities in the entire PHC area. One copy of the VC – 4 is retained at the PHC for its own record. The VC – 4 from all PHCs are consolidated at the district level in the next 15 days and sent to the state. The state should compile and forward the report so as to reach the NVBDCP within 45 days of completion of the activities. The format of VC – 4 is attached as appendix B.

### **9.3 District LLIN Log (VC - 6)**

The data on annual distribution of LLIN is entered into the district LLIN Log (VC - 6) at the end of each year from details given in the VC - 4. The number of LLINs projected in the annual plan is calculated on the basis of availability of nets as given in VC – 6. The calculation will take into account the effective life of LLINs already distributed in the village, for example, for LLINs with a life of 3 years distributed in 2010 will require replacement in 2013 and those distributed in 2011 and 2012 will not require replacement in 2013.

For LLIN with an expected effective life of 5 years, the calculations can be modified accordingly. LLIN earlier delivered separately through the ANC mechanism also must also be considered. If LLIN with two different durations are available in a village/subcentre area, the log will be calculated and maintained separately, using two separate forms. While planning for LLIN distribution, the village level bed net survey results must also be taken into account for each village. The format of VC – 6 is attached as appendix C.

The Directorate of NVBDCP will coordinate the monitoring and evaluation of the LLIN distribution plan, making sure that all possible sources of malaria relevant information are being used such as Demographic and Health Surveys, HMIS data compiled from districts and facilities, and data from malaria surveillance activities and other surveys by various partners. Implementation progress will be reviewed in the districts on a quarterly basis by using the Malaria Technical Supervisors (MTSs).

#### **9.4 Core indicators**

The core indicators used to assess progress towards the achievement of the targets of LLIN use are as follows.

- Proportion of children under 5 years who have slept under an ITN the previous night out of the target population
- Proportion of households with one or more LLIN out of the target population for LLIN distribution
- Proportion of pregnant women who have slept under an LLIN the previous night out of the target population

### **10. Quality Control**

#### **10.1 Specifications**

The average number of complete holes/in<sup>2</sup> shall be not less than 156 and the lowest value shall be not less than 148. The minimum bursting strength for acceptable netting materials should be 250 kPa. For acceptable performance, the seams must be at least as strong as the netting. The shrinkage in either direction of the netting material should be no more than 5%. The durability of nets and netting materials is a very important characteristic for the user but there is a lack of simple tests which measure, or predict, resistance to the “wear and tear” arising from normal use.

The choice of yarn is usually related to economic or comfort considerations, however, evidence should be there on the uptake of insecticide formulation and the retention of active ingredient. The design should be specified, e.g. shape, size, color, etc., according to local habits or the requirements of the application.

A minimum filament count of 36 is accepted for the yarn to be incorporated into polyester netting material. Monofilament yarn is suitable for netting made of high density polyethylene. The linear density is a characteristic of the yarn expressed in denier units (grams per 9000 meters). Polyethylene nets are commonly made of higher denier yarn than polyester nets.

#### **10.2 Testing and Trials**

Prior to shipment of the first procurement, the manufacturer will agree to provide samples of LLIN for chemical testing to determine the presence of the insecticide within an acceptable range of the target dose. In-factory sampling of the nets and subsequent testing will be done by an independent agency. Quality control of LLINs will be done by testing on 10 nets per production batch. The initial concentrations of insecticide should be within 20% of the manufacturer’s target concentration. The method of testing will vary

as below depending on the type of net fiber. Initial insecticide concentrations of polyester nets will be measured by high performance liquid chromatography (HPLC) for deltamethrin and by gas chromatography (GC) for alpha-cypermethrin treated nets. The initial testing of polyethylene nets will be done by GC. The following will also be ensured prior to shipment by the independent agency:

- Nets correspond to the size, shape, stitching and color specifications of the procurement
- Each bale contains the correct number of nets
- Adherence to specifications approved by Gol for mesh size and denier
- Absence of other defects resulting from knitting, stitching, treatment or packaging processes.

If the results of these tests and inspections are not satisfactory, the order will be cancelled. Contracts with LLIN manufacturers will make it clear that independent quality control activities will be conducted prior to accepting the shipment, and that orders failing to meet the quality control standards will be cancelled.

If through routine monitoring, the LLIN purchased consistently fail to meet quality standards during actual field use, all orders would be terminated and no further procurements from that manufacturer will occur until there is sufficient evidence of improved manufacturing processes and product durability.

The manufacturer should provide:

- details of registration with CIB
- statement of production output capacity
- full product dossier
- audited accounts for the last three years

Although some observations on the safety of LLINs will be carried out in the field, a preliminary safety assessment has to be undertaken, following the generic risk assessment model developed by WHO for this purpose, before any field study can be done. In addition, the physical properties of the fabric and factors relating to its structural integrity should conform to WHO specifications for netting materials.

Phase I testing includes

- determination of the period of time required for full regeneration of the LLIN after washing;
- determination of the efficacy and wash resistance of the LLIN against susceptible vector species.

Nets washed at least 20 times that cause >80% mortality and/or >95% Knock Down (KD) meet the criteria to undergo Phase II testing.

Phase II testing includes testing for efficacy of LLIN in small-scale field trials for blood-feeding inhibition, deterrence, induced exophily and mortality in experimental huts using susceptible, free-flying, wild mosquitoes. These studies include recording the perceived side-effects of LLIN among users. Cone bioassays are performed after each wash. The last wash for which the net still causes >80% mortality or >95% KD is considered to be the number of washes required before exhaustion.

In view of the long-term studies that may be required to fully test or evaluate an LLIN product, *interim recommendations* on its use for malaria prevention and control may be given subject to the following: use of WHO-recommended insecticides in making the LLIN; satisfactory completion of laboratory and small-scale field testing; and confirmation that after at least 20 standard WHO washes, the LLIN performs equal to or better than a conventionally treated net washed until just before exhaustion.

In Phase III (large-scale field) trials, the efficacy, longevity and fabric integrity as well as the community acceptance of an LLIN will be studied in household randomized trials. If, at the end of 3 years, at least 80%

of nets meet the cut-off criteria for either the WHO cone bioassay test or the tunnel test, then the product meets the definition for an LLIN.

## 11. References

1. Guidelines for laboratory and field testing of long-lasting insecticidal mosquito nets. World Health Organization WHO/CDS/WHOPES/GCDPP/2005.11; 2005.
2. Technical consultation on specifications and quality control of netting materials and mosquito nets. World Health Organization Geneva 2007.
3. MALARIA VECTOR CONTROL DECISION MAKING CRITERIA AND PROCEDURES FOR JUDICIOUS USE OF INSECTICIDES. WHO/CDS/WHOPES/2002.5 World Health Organization. Communicable Disease Control, Prevention and Eradication. WHO Pesticide Evaluation Scheme (WHOPES)
4. Strategic Action Plan 2007-12 India Malaria Programme. NVBDCP.
5. Operational Manual for implementation of malaria programme. NVBDCP, 2009.

**Annexure 'A'**

<b>NATIONAL VECTOR BORNE DISEASE CONTROL PROGRAMME</b>									
<b>VC – 3: Primary record of bednet delivery and impregnation</b>									
<b>Village</b> .....						<b>Village Code</b> .....			
<b>Sub-Centre</b> .....						<b>PHC</b> .....			
					<b>SUMMARY - HOUSES</b>				
Activity		Planned Date	Actual Date			Total No.	No having at least two Effective Bednets	% of houses covered	
Survey									
Impregnation									
Distribution									
<b>Name of volunteer/ASHA/AWW</b> .....									
Ser. No	Name of Head of family	Number of persons living in family	No. of bed nets required for total coverage	Number of bed nets (including community owned) available as per household survey		No. of bed nets distributed		No. of ITNs impregnated (out of Col 5 and Col 7)	Total Effective Bednets (Col 6+ Col 8 + Col 9)
				ITNs	LLINs*	ITNs	LLINs		
1	2	3	4	5	6	7	8	9	10
<b>Total</b>									
<b>* LLINs within life span to be counted</b>						<b>Synthetic Pyrethroid</b>			<b>Quantity</b>
<b>Volunteer's name and signature</b> .....						<b>Available before impregnation</b>			
<b>Health worker's name and signature</b> .....						<b>Utilized for impregnation</b>			

**NATIONAL VECTOR BORNE DISEASE CONTROL PROGRAMME**

**VC – 4: Bednet Output Report Form**

Name of District/ PHC: .....

Name of PHC/ sub-centre/village with net impregnation target population	Village Code	Total Population	Total No of Houses	No. bed nets required for total coverage	Survey		No. of bed nets (including community owned) available in household survey		Distribution		No. of bed nets distributed		Impregnation		No. of ITNs impregnated	Total Effective Bednets	Synthetic Pyrethroid			No of Households with two Bed nets	Population Coverage (% of households with at least two effective bedtnets)
					Planned date of survey	Actual date of survey	ITNs	LLINs*	Planned date of distribution	Actual date of distribution	ITNs	LLINs	Planned date of impregnation	Actual date of impregnation			Quantity of Pyrethroid received	Quantity of Pyrethroid utilized	Quantity of balance pyrethroid		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
<b>Sub-centre 1 Total</b>																					
<b>Sub-centre 2 total</b>																					
<b>PHC Total</b>																					

\* LLINs within life span to be counted

NATIONAL VECTOR BORNE DISEASE CONTROL PROGRAMME								
VC – 6: District LLIN Log								
Name of sub-centre/ village	Number of LLINs delivered by year							
	20__	20__	20__	20__	20__	20__	20__	20__
Sub-centre 1								
Village 1								
Village 2								
Village 2								
Sub-centre 1 total								
Sub-centre n								
Village 1								
Sub-centre n total								
<b>PHC total</b>								