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Long-Lasting Insecticide-Treated Bed Net Packaging Considerations

USAID | DELIVER PROJECT 2012

LLINs are packaged in individual bags and wrapped in an outer covering.

Malaria prevention programs are pursuing packaging options for LLINs that reduce waste, or make it easier to dispose of packaging.

The use of long-lasting insecticide-treated bed nets (LLINs) to prevent the transmission of malaria is producing successful results worldwide. But, for some recipient communities, one result of this success has been the accumulation of used LLIN packaging. If managed incorrectly, this used packaging can expose local populations to toxic substances.

Stakeholders and partners in the malaria prevention community are responding to the challenges posed by accumulating LLIN packaging waste. For instance, the World Health Organization (WHO) developed draft recommendations for managing LLIN packaging waste. Manufacturers are also offering a choice in packaging materials, which can contribute to easier disposal of individual LLIN bags. Another response—at least for LLINs distributed through campaigns—has been for manufacturers to pack the LLINs in bulk, not in individual bags.

This document includes information about each of these possible responses. However, even after procuring any of the various LLIN packing options, implementers must follow up appropriately in the field. To assist donors, programs, and the malaria prevention community with their procurement decisions, this document details the necessary considerations and potential ramifications to malaria prevention activities for the following three options:

1. not specifying any particular type of LLIN packaging
2. procuring LLINs in individual bags, but stating that a specific packaging be used
3. procuring LLINs that are packaged in bulk instead of individual bags.

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Definitions

- **Individual bag**: A covering that completely encases one LLIN
- **Baling material**: The packaging, including the outer wrapping, plastic straps, and bands that are used to bundle multiple LLINs into compacted bales of up to 200 LLINs each
- **LLIN packaging**: Either individual bags, baling material, or a combination of both
- **Continuous/routine LLIN distribution**: Supplying LLINs at no charge through channels that usually target young children and pregnant women—such as routine immunization programs and antenatal visits; usually obtained at health facilities and taken from there to the recipient's homes
- **Campaign distribution**: The supply of LLINs at no charge to communities and households with the objective of having universal coverage for the entire population at risk for malaria.

USAID | DELIVER PROJECT 2009

Outer baling material covers individually wrapped LLINs.

Minimizing the Environmental Impact of LLIN Packaging

The recently drafted *Draft Interim Recommendations on the Sound Management of Packaging for Long Lasting Insecticidal Nets* (WHO 2011) suggests that if LLIN packaging is managed poorly, the following may result:

- pesticide poisoning when the packaging is reused for food storage
- pesticide pollution in soil and groundwater
- dangerous persistent toxins from uncontrolled open-air burning.

Stakeholders involved with LLIN distribution programs can reduce the risk from any of these events by learning about these recommendations. Briefly outlined below are some practices that the WHO draft recommendations encourages implementers to adhere to, and others to avoid, when working with LLIN packaging in the field.

A distinction between plastic bag waste and LLIN packaging waste

Plastic bag waste is more than just a persistent visual blight. It is a solid waste management challenge made more complex when it's burial or incineration, releases harmful compounds into the air, soil, and water.

While these problems have not been directly linked to LLIN packaging waste, its accumulation in communities does raise similar concerns as the significant amount of packaging that accumulates at distribution sites appears, in many ways, to look just like other plastic bag waste.

However, LLIN packaging waste is not the same as plastic bag waste. Pesticides are used when LLINs are produced. Subsequently, because the bags have trace amounts of pesticides after the LLIN is removed, they can be classified as used pesticide containers (WHO 2011).

Do Not—

- encourage the re-use of LLIN bags for any other purpose to avoid the risk of pesticide poisoning
- burn LLIN bags and baling material in the open air
- dispose of LLIN packaging as ordinary waste or in improper sanitary landfills.

Do—

- ensure that workers use proper personal protective equipment (PPE) during all stages of operations for collecting, sorting, recycling, and disposing of LLIN packaging
- incinerate LLIN bags and baling material only if specified high-temperature incineration conditions for pesticide-tainted plastic can be guaranteed; and if Food and Agricultural Organization (FAO)/WHO and Basel Convention guidelines, as well as national regulations and requirements, can be strictly followed
- store used LLIN packaging to be recycled or disposed of in dry, ventilated, and secure facilities
- consider recycling LLIN packaging—described in more detail below
- dispose of LLIN packaging away from any residences, in a landfill that will not leach contaminants, if the manufacturer does not recommend recycling or incineration.

Individual Packaging for Each LLIN

The complexity of properly handling LLIN packaging waste may influence a decision, within programs, to completely stop using individual bags for each LLIN. However, unless they are distributed during campaigns where LLINs are brought close to the end users, this would not be recommended; if the LLIN was distributed at a central point, like a health center; and then transported some distance to individual homes, the LLIN might be damaged before it is hung. If this is the case, programs may still want to consider using individual bags for use in continuous or routine distribution.

Why Each LLIN May Need an Individual Bag

Even if individual bags can be eliminated for the LLINs; for example, when they are distributed directly to households; there may be circumstances, such as those described below, when the best option is to keep the individual bags.

Users Are Given Information and Messages Using Printing on the Bag

Examples:

- country flag, Ministry of Health (MOH), donor logos, or text (for example, *Not For Resale*)
- malaria-prevention messages, donor-participation promotion, or social marketing messages
- manufacturer and branded product names
- instructions for proper mounting and use in the national language(s)
- size, shape, fiber composition, filament count of the LLIN

- standard pictograms for washing, care, installation, and use.

Facilitates Compliance with Local, National, and International Regulations

- When the country does not have a national pesticide regulatory authority, the standards of the *International Code of Conduct on the Distribution and Use of Pesticides* (FAO 1995) and *Guidelines on Good Labelling Practice for Pesticides* (FAO 2008) could be interpreted at country level to require that some of the following information be placed on the packaging:
  - instructions for packaging disposal
  - name of the pesticide used and the concentration of the active ingredient
  - manufacturing lot or batch number and date of manufacture
  - national product registration identifiers.
- *UN Recommendations on Transport of Dangerous Goods* could be interpreted as limiting the amount of active ingredient that can be transported within a single unit of packaging; this could possibly limit transport options if bulk packaging is used (UN 2001).
- Programs, donors, or manufacturers—if the country does not have national requirements for pesticide transport—prefer to package LLINs in individual bags; in order to demonstrate due diligence in avoiding leakage of pesticides into freshwater waterways during transport.
- Programs and donors may defer to the *Guidelines for Procuring Public Health Pesticides* during the procurement process—it recommends that LLINs be packaged individually in sealed plastic bags that are sufficiently strong to prevent damage during transit (WHO 2012).

Supports LLIN Distribution Activities

- If all LLINs are packaged individually, nothing will prevent them from being allocated between routine and mass distribution, as needed.
- Some programs insert additional documentation in or on the bag.
- Some programs keep the empty bags and use them to track LLIN distribution figures during campaigns.

Protects Product during Storage, Local Transport, and Handling

- makes quick identification easier—size, shape, donor—throughout the supply chain
- supports product stability, over time, by limiting exposure to heat, humidity, and sunlight
- helps LLINs remain clean when they are stored at health facilities before routine distribution
- provides physical protection against snagging, tearing, or puncturing of the netting during transport
- can reduce dermal reactions resulting from continual exposure to pesticide during distribution.

Options for Individual Packaging of LLINs

Whatever packaging is specified when a decision is made to use individually packaged LLINs, it should be the minimum necessary to maintain the full integrity of the product prior to use. If the decision is made to dispose of LLIN packaging in landfills or via incineration, no special considerations are needed about the type of plastic polymers to be used. But, for those programs that will also manage the disposal of the packaging, there are additional options currently available; these are discussed in further detail below.

Biodegradable packaging: Some LLIN manufacturers state that oxy-degradable packaging maintains the integrity of stored LLINs the same way as regular plastic; and, it can be recycled. This type of packaging contains chemical additives that, in the presence of light and oxygen, accelerate the degradation of the plastic films into small fragments of material that are biodegradable.

Many suppliers of LLINs can provide this kind of packaging, if it is requested during the procurement process. If LLIN packaging is going to a landfill, an incinerator, or being recycled this option may not be a good choice because these bags typically cost slightly more than standard bags and sourcing them in quantity may extend procurement lead times. Recyclers might also not accept them because of the polymers used in their manufacture.

Bags made out of paper or other non-plastic materials are not commonly available from LLIN manufacturers. Jute and paper bags have been used for repackaging LLINs, but the host-country program provided them, not the supplier. Programs are reminded that even if biodegradable LLIN packaging is used, the waste from the bands, and the strapping and baling materials, should still be disposed of; according to the WHO guidelines, this packaging option should still be treated as used pesticide containers after the LLIN is removed.

Recyclable Packaging

Individual bags for LLINs and baling material are made from a variety of materials, including low density polyethylene (LDPE), LDPE coated with polyethylene terephthalate (PET, polyester), linear low density polyethylene (LLDPE), and oxy-degradable polymers (WHO 2011). Although all these types of packaging materials can be, potentially, recycled, recyclers may prefer only specific ones, and some recycling programs may not accept certain plastics.

If LLIN packaging is to be recycled, knowing which polymers will be accepted by in-country recyclers can inform the procurement process for the type of packing material to be specified when LLINs are procured. It would also be important to specify that the type of polymers used should be clearly identified on each bag. Note also that specifying the type of polymers to be used for packaging LLINs may reduce the number of available responsive suppliers or extend procurement lead times.

Notes on Recycling LLIN Packaging

LLIN recycling is the reprocessing of the materials from the LLIN packaging to make other products.

Recyclers who process used LLIN bags and baling material should apply proper controls for their materials and processes. They should also understand that the non-biodegradable, pesticide-tainted materials can only be recycled into appropriate non-consumer products, which are unlikely to come into contact with humans and are not likely to be recycled again.

In addition to knowing the composition of the packaging, programs should alert recyclers about how the packaging was generated, collected, and the possible risks from contamination and handling. This will help improve the recycling process and reduce the risk to employees when they handle the packaging.

With any option, manufacturers should be encouraged to always provide detailed information on the exact composition of materials used in the manufacture of their LLIN packaging. Ideally, this recommendation would be written on the bag. They should also be encouraged to provide guidance on the disposal and/or recycling of LLINs packaging using the best available techniques and best environmental practices. These directions for safe disposal should go beyond a standard text of *follow national guidelines* and they should be made available to all programs.

Implications for Malaria Prevention Programs Using Individual LLIN Packages

Alignment of LLIN Packaging Disposal with Existing Policies

The safe collection and disposal of large volumes of LLIN packaging waste generated through campaigns is feasible if there is adequate infrastructure. Malaria prevention programs should consider integrating good practice recommendations on the sound management of LLIN packaging into their existing national malaria strategy and related frameworks (WHO 2011).

The use of pesticides can be subject to regulations developed by government ministries, including ministries of health, the environment, and labor. Subsequently, the treatment and disposal of LLIN packaging should follow these laws and regulations concerning the safe handling and disposal of pesticide-tainted waste already in place in the country. Where no specific regulations or law exists, international standards and guidelines developed by WHO or other institutions may possibly be applied to ensure the safety of health workers, the population at large, and the environment.

Malaria prevention programs examining LLIN packaging disposal may be able to benefit from researching the existing protocols in place by any indoor residual spraying program already being supported, because these programs also generate used pesticide containers. Additionally, host country ministries of agriculture will probably have a lot of experience managing used pesticide containers; they can be a very useful repository of information.

Costs

Using individual packaging for each LLIN may add procurement costs for a package that will ultimately be discarded. Sometimes, even during mass distribution campaigns, the individual bed net packaging is removed before it is given to a recipient. This practice stems from concern that the recipient, if given an unopened LLIN package, may sell it. In addition to reducing the likelihood of resale, this practice also encourages the prompt hang-up of bed nets and, in some cases, to facilitate additional markings or labels to be affixed to the LLINs. If this practice is in place, some of the purposes for the bag; and, by extension, the possible costs put into the packaging, may not achieve the desired impact.

Any program that plans to manage the disposal of LLIN packaging should factor in the requirements and related costs to move the packaging to incineration, recycling, or disposal sites.

Bulk Packaging of LLINs

When LLINs are packaged in bulk, they do not have individual bags. However, they can still be bundled individually with straps or bands, be compressed, be packed in bundles, and be covered with an outer packing.

Implications for Malaria Prevention Programs with Bulk Packaging

Programs already planning the distribution of LLINs through campaigns should consider the effect on the environment, proposed packaging, and storage needs before deciding to package and deliver the LLINs in bulk instead of in individual bags.

Environmental

With bulk packaging, instead of individually wrapped LLINs, workers and others may be concerned about pesticide exposure at the point of distribution, because repeated handling of some pesticides may cause skin irritation. Therefore, it is important to include appropriate information and to promote appropriate worker safety practices for individuals who distribute the bed nets.

Eliminating the individual bag significantly reduces the amount of waste produced, but it does not eliminate all waste from LLIN distribution—the packaging of bales and bands must still be handled. Moreover, the baling material, which normally only has a limited contact with the pesticide when LLINs are packaged individually, must now be treated as a used pesticide container after the LLINs are removed.

Packaging and Storage Needs

With LLINs being packed in bulk, rather than individually, ensuring the insecticide shelf life is maintained after the bale is opened may be of more concern. Reducing the number of packed bed nets per bale could reduce the length of time that LLINs are stored in open bales. Also, LLINs could be damaged when they are in storage. To address these concerns, programs could specify the thickness of the plastic used to bale the bundles; or, to ensure the bed nets are not damaged during bailing, manufacturers could be asked to insert a liner inside each bale.

Transport

When LLINs are transported, manufacturers are responsible for determining whether or not they should be classified as environmentally hazardous substances. Not all manufacturers consider individually packaged LLINs to be hazardous substances while they are being transported because this determination can be influenced by a number of factors, such as production location. Currently, manufacturers do not uniformly agree on regulations that might apply to LLINs packaged in bulk. However, increasing the amount of active ingredients in a single shipping unit—for example, when multiple quantities of LLINs are packed in a bale—could change their shipping classification because of the increased risk of toxicity to terrestrial and aquatic life. Therefore, shipping in multiple quantities may require additional transport controls that do not apply when a single LLIN is packed in an individual bag.

Communications

If each LLIN is not in an individual bag, fewer options are available for using the surface of the packaging to convey information for instructional and programmatic purposes. Printing text on straps or bands, sewing an informational tag into the LLIN, or providing literature with the LLIN, could be options that would compensate for the loss of the individual bag.

Campaign Distribution Methodologies

If bulk packaging of LLINs is being considered, the distance between an LLIN distribution point and the home where they will be used should be considered. Bulk packaging may not be appropriate

for mass campaigns using community distribution points when LLINs are first stored and then distributed to recipients from a number of villages within walking distance. The concern is that the LLIN may become damaged while being transported between the distribution site and the recipient's home. Manufacturers claim that polyethylene (PE) monofilament incorporated LLINs are far less susceptible to this type of damage and from insecticide loss than multicoated multifilament.

However, bulk packaging might work well in a door-to-door delivery campaign, because, in this type of campaign, LLINs are pre-positioned close to the implementation area and the LLINs are given directly to beneficiaries at their homes. This could minimize the distance that the LLINs are transported and, potentially, any damage to them. Using bulk packaging can also mean a more efficient distribution process than one in which workers must remove LLINs from their packaging or open packaging before LLINs can be distributed.

Costs

Programs considering bulk packaging should understand the potential for cost savings. These could be through slight reductions in shipping weight and volumes that may result in decreased costs to deliver LLINs from the supplier. Eliminating the individual bag may also decrease the manufacturing costs.

Countries, for example, Uganda, have used bulk packaging to reduce the costs per LLIN, both for procurement and distribution costs (Results for Development 2012). However, LLIN pricing depends on many elements, making it extremely volatile and difficult to ensure that eliminating LLIN packaging will always translate into reduced program costs. When there are potential savings, programs may be able to purchase additional LLINs with the same amount of funding. Conversely, bringing LLINs closer to recipients, to avoid damaging them, may increase costs.

Summary

This document details two different types of LLIN packaging options—biodegradable and recyclable—that can help malaria prevention stakeholders address the challenge presented by the accumulation of LLIN packing waste in communities. It also detailed another option to vastly reduce the amount of material by packaging LLINs in bulk when they will be used in campaigns. All of these options are alternatives to forgoing any special type of packaging. With each option, programs and stakeholders should review the many contextual issues before deciding the best solution for them. Ultimately, any decision that will contribute to a well-managed LLIN packaging waste plan will contribute to an improved malaria prevention program and a reduced risk of contaminating the environment.

References and Additional Reading

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Task Order 7 supports USAID's goal of reducing the malaria burden in sub-Saharan Africa by procuring and delivering safe, effective, and high-quality malaria commodities; by providing technical assistance and on-the-ground logistics expertise to strengthen in-country supply systems and build capacity for managing commodities; and by improving the global supply and long-term availability of malaria commodities.

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