AMP The Alliance for Malaria Prevention

Expanding the ownership and use of mosquito nets

Use of shipping containers for short-term[1] storage of insecticide-treated nets after being delivered: operational concerns and considerations

1. Summary

This document is written in response to concerns raised by members of the Alliance for Malaria Prevention (AMP) partnership, which is comprised of national malaria programmes, private and public sector partners, as well as faith-based and humanitarian organizations, regarding storage of insecticide-treated nets (ITNs[2]) in shipping containers after they have been transported and the possible effects on product integrity and quality.

Until now, recommendations on the use of shipping containers for in-country storage of ITNs, based on experiences to date, have not been consolidated in a document easily accessible to national malaria programmes and partners to aid in decision-making about ITN storage for mass campaign or continuous distribution.

Countries should prioritize other storage options before considering containers

Pending availability of additional data, AMP does not recommend storage of ITNs in containers **for any more than two weeks** after delivery to final destination in-country, given the potential risks of distributing ITNs that have become sub-standard as a result of exposure to high temperatures and/or humidity. It is important to highlight that none of the World Health Organization (WHO) pre-qualified (PQ) ITN suppliers surveyed recommends storing their ITNs in containers upon delivery in a country[3].

2. Concerns about container storage of ITNs

Ensuring distribution of high-quality, effective insecticide-treated nets (ITNs) is critical to ensure the protection of affected communities against malaria, to sustain progress in the fight against malaria, and to maintain the credibility of national malaria programmes, their implementing partners and donor agencies.

An intermodal container is a large standardized shipping container, designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport – from ship to rail to truck – without unloading and reloading their cargo. In recent years, a number of malaria-endemic countries have chosen to purchase and use intermodal

[1] No more than two weeks.

[2] For the purposes of this document, ITN is considered to include long-lasting insecticidal nets (LLINs), as well as all new and forthcoming net types (PBO, next generation nets).

[3] See Annex 1: ITN manufacture packaging and shipment specifications survey.

containers, commonly referred to as shipping containers, to store ITNs prior to distribution through mass campaign or continuous distribution channels.

National malaria programmes cite saved time, labour and costs, as well as ITN security, if shipping containers are used rather than having to identify and contract secure warehouses or other storage facilities to store ITNs. Where containers have been purchased for ITN storage, national malaria programmes also identify the advantage of not having to re-budget for extension of storage rental periods for weeks or months due to ITN distribution delays (largely for mass campaigns).

Storing ITNs in unventilated or otherwise unmodified shipping containers, where there is possible exposure to short periods of time exceeding a temperature threshold, high sustained temperatures and/or high humidity and moisture, has not been well researched to date in terms of the potential effect on the efficacy of the ITNs. Given the lack of data being collected through data trackers or other means where ITNs are stored in shipping containers upon delivery to countries, it is not possible to know whether the manufacturers' specifications about storage temperature, including temperatures that should not be exceeded, have been respected, although it should be noted that no ITN manufacturer surveyed recommends storing their ITNs in shipping containers upon delivery to countries[4].

In addition, two national malaria programmes that have used containers for storage for extended periods of time (more than six months) have reported problems with staining of ITNs, packaging sticking together and printing melting off packages[5].

Given concerns among ITN partners and stakeholders, AMP is putting forward this document with points for consideration, based on operational experience to date and the typical amount of time for the clearing of ITNs once at port, for national malaria programmes and partners considering procurement and use of shipping containers for ITN storage beyond 14 days if there is a lack of other storage/warehousing options. Note that this document does not represent WHO policy, technical guidance or recommendations.

3. Points for consideration if shipping containers will be used for short-term storage (beyond 14 days)

The practice of using the actual shipping container which shipped ITNs from the manufacturer is not recommended as the container quality cannot be assured in advance and modifications cannot be made immediately on delivery at the storage site. If containers are to be used as temporary storage, it is recommended that empty, intact, clean containers are pre-positioned at the storage site, to be filled by hand (or forklift). This would require the procurement of containers in advance separately from the procurement of the ITNs.

The recommendation remains that ITNs **should not be stored** for longer than two weeks in the shipping containers used to transport the ITNs from the manufacturer. The points in the table below should be considered where container storage of ITNs is required beyond two weeks **due to lack of any other storage options**.

[4] See Annex 1 for findings from the supplier survey finalized in November 2019.

[5] Note that this is only from limited sources. More work is required to understand, qualitatively, what effects shipping container storage has had.

Concern	Consideration
Container quality	When containers are being purchased (as per above, separately from the containers used for shipping the ITNs), it will be important to specify the quality of the container desired, particularly where it is planned that containers will be used for storage of other items after the ITN distribution (see below). Where it is necessary to store ITNs in containers, it will be important to ensure that last shipment (end of life) containers are not used due to the strong possibility that they are in poor condition and may put ITNs at risk of damage pre-distribution. Container colour has been found to have an impact on both temperature and humidity[6]. Light colours will have a lower temperature and less fluctuation in humidity as a result. Better quality and newer containers will have a higher cost, as will specifying the container colour, which may not be a readily available option.
Delivery levels and infrastructure	Road and transport infrastructure must be considered when planning for delivery of containers to be used for ITN storage. For safe unloading of containers from trucks, a speciality vehicle like an intermodal tipper truck or a crane should be used, which may not be readily available and may be expensive. Trucks in good condition and of the appropriate size may be limited, increasing the transport time and the planning detail required for coordinating the arrival of trucks and the availability of special vehicles or cranes. Verify the possibility for container delivery prior to placing the order for ITNs and the shipping containers. Determine where container delivery is not possible and ensure planning and budgeting for appropriate warehousing/storage. Where available storage may not meet the procurement requirements in place within the Ministry of Health or the donor organization responsible for the warehouse costs, ensure that detailed requests for approval of identified storage are made early.
Days planned for storage	The number of days that the ITNs will be stored in containers prior to their transport to subsequent levels of the supply chain is important to take into consideration. As far as possible, the ITNs should get port or customs clearance as quickly as possible and then be moved to appropriate storage locations. When ITNs will need to be stored for longer than two weeks, measures to mitigate against risks related to heat, humidity and moisture exposure must be put in place (planned and budgeted) – see below. Alternatively and ideally, appropriate warehouses or storage locations should be secured early for those ITNs that will be stored for two weeks or longer.
Preparation for container arrival	It is important to plan for the arrival of the containers well in advance. This includes: • Identification of the site(s) where the containers will be dropped. These sites should be far from water sources or areas that can pool water after rains. Given the difficulties and costs in moving containers, the delivery location should be the final resting location for the container. • Preparation of the ground, to ensure that it is flattened, and that the container can be securely positioned. Ensure there is opportunity for water to dissipate around the containers to prevent

[6] https://eprints.usq.edu.au/27322/1/Carey_2014.pdf

Concern	Consideration
	humidity build-up. • Utilization of container stands to ensure that the containers do not sit directly on the ground in order to reduce risks related to dampness and humidity, particularly with wood-floored containers. • Using natural shade, as far as possible. Temperatures inside containers in the direct heat of the sun at midday can rise 20˚C or more. Where natural shade is not an option, appropriate shading that protects the container from exposure to direct sunlight throughout the day should be constructed to reduce the effects of high heat. Construction of the shading structure should not contribute to any pooling of water. • Purchase of locks and chains for security since the containers will need to be opened and a physical inventory carried out (see below). • Purchase of lights (and battery packs as needed) that can illuminate the area around the container to reinforce security (where these do not already exist in the identified delivery site). • Keeping plants, brush, and debris away from exterior container walls.
Container modification	• Inexpensive turbine fans mitigate excessive levels of heat, dust build-up, moisture, carbon dioxide levels and other air pollutants and require no power to operate. • A small screen vent placed near the bottom of the container at the door end, combined with a turbine fan at the top of the opposite wall, will enable continuous air flow. • High quality, solar-reflective paint can be applied to containers to lower the surface temperature by about 3-6°C. If specialized reflective paint is unavailable, white paints typically reflect 80 per cent of visible light and can help mitigate heat. Painting the exterior of a 20ft (6 metre) container will require 20 litres of paint, or 35 litres for a 40ft (12 metre) shipping container. See https://www.ghsupplychain.org/use-containers-temporary-emergency-storage-tips-mitigate-temperature-and-humidity for more details
Reception of ITNs and potential need for additional storage	To confirm that the containers contain the quantities indicated on the shipping documents, the receiver (e.g. national malaria programme, implementing partner) and a reception committee (where part of the logistics plan and budget) must open containers at the point where custody of the ITNs is transferred to the receiver, unload bales, verify the quantities received and report any discrepancies. The transporter must be released as soon as possible to avoid incurring additional charges; therefore, the reception, offload (and reload to containers, preferably separate from the containers the ITNs were shipped in), physical count and verification and sign-off on tracking tools must be done in a timely manner[7]. After the arrival of the container at the delivery site where unstuffing of the containers for physical count of bales is conducted, it is likely that

[7] The procurement agent responsible for the delivery of the ITNs will normally establish a timeline for the receiver to acknowledge reception of goods, after which any loss reported during the offload will not be covered through their contract and insurance.

Concern	Consideration
	some bales will not fit in the container being used for storage. Since bales are packed mechanically at point of origin, only an estimated 75—80 per cent of the bales can be manually repacked to fit in containers, thus requiring additional containers or storage sites for small quantities of bales, plus trucks and staff to transport those bales that cannot be replaced in the container to where they will be stored[8].
Container verification	During the unstuffing of the containers for the physical inventory of bales received, the container itself, if it will also be used for storage of the bales on arrival in-country, must be inspected to ensure that there are no leaks, holes or weak points. This same process of container inspection should take place where containers are purchased separately for ITN storage purposes. Where the container condition is not specified in the shipping documents (e.g. not end-of-life containers), any repairs needed to ensure safe, dry storage of the ITNs will need to be undertaken and paid for by the national malaria programme or implementing partner. Where repairs are needed, alternative storage for ITNs pending container availability will need to identified until the containers are in good enough condition for ITN storage. This issue should form part of the risk assessment and mitigation planning and associated budgeting. Where the container condition is specified and the container does not meet specifications, the national malaria programme will need to work with the procurement agent to identify when repairs will take place and how they will be paid for.
Security	Storing ITNs in containers does not negate the need for security, particularly when a large quantity of ITNs is being stored in a single location. Budgets should include costs for guards (private or public) 24 hours a day for the area where the ITNs are stored in the containers. Where this is a large area/large number of containers, the number of security personnel should be planned appropriately. Keys for opening the containers should be kept with logistics and warehouse management personnel (clear standard operating procedures should be put in place detailing who should open containers and when) and not left at the container storage area or with security personnel.
Physical inventories of stocks	Based on the asset management plan in place within the Ministry of Health or through the funding partner, regular physical inventories of stocks should be undertaken to ensure no loss or leakage of ITNs in storage. Budget considerations may include security and labourers during the unpacking and repacking of the containers.
Monitoring of temperature and humidity during storage	Where containers are necessary for storage of ITNs, strong consideration should be given to ensuring that budgets include purchase of data trackers to allow for registration and verification of the temperature and humidity conditions in the containers[9] on a regular basis. This would provide the data to make changes (for example, to move the ITNs to warehouses or other storage locations) where the temperature and humidity can be better controlled.

[8] Estimates by AMP logistics experts based on needs for space for inventories, bale volume and manual packing capacity.

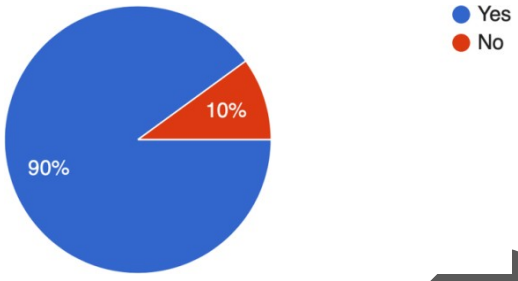
[9] PQT guidance would be sought regarding the data trackers and the frequency of data collection, as well as its analysis.

Concern	Consideration
Use of containers for storage after ITN distribution	The use of the containers after the ITN distribution should be planned from the time the decision to procure containers is made. Many products – such as case management supplies, etc. – cannot be safely stored in containers due to the risks associated with high temperature and/or humidity exposure without the container being sufficiently modified. Future use of containers should be only considered for products that have no heat or humidity exposure risks.

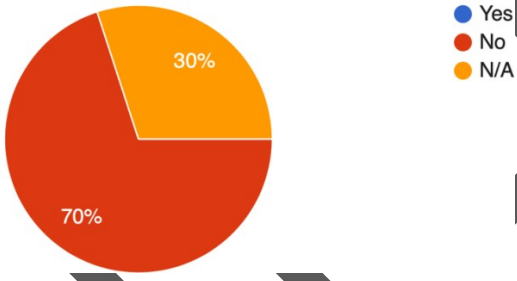
Annex I - ITN manufacture packaging and shipment specifications survey – September 2019

Manufacturers' responses to questions related to storage in shipping containers[10].

Do you have recommendations on how your ITNs are stored upon delivery to the recipient? [10 responses]



Do the recommendations differ by type of product [10 responses]

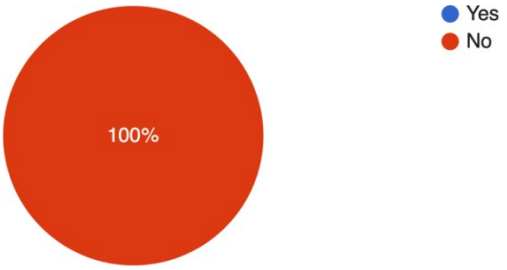


If you answered yes to the question above, please describe your storage recommendations by type of product.

- Cool (as possible), dry and out of direct sunlight.
- No exposure to light, high humidity or very elevated temperatures.
- All LLINs should be stored in a normal condition temperatures and not high temperatures.
- Store in cool and dry place.
- Out of direct sunlight. To be stored in a dry ventilated place under normal indoor temperature; bales should be stacked on pallets.
- As per our safety data sheet: Store in ambient temperature and at atmospheric pressure in original packaging. Do not store near highly flammable materials. Store product in closed packing in a cool area away from direct sunlight.
- We recommend not to have container storage. For standard storage: always keep the product in the shade and also dry.

[10] The whole survey and responses from manufacturers can be found in *ITN manufacture packaging and shipment specifications survey*. AMP.

Do you recommend storage of your ITN products in containers upon delivery in a country? [10 responses]



How long after port clearing can your ITNs be stored in containers at increased temperatures with limited risk of package and product deterioration? [1 response]

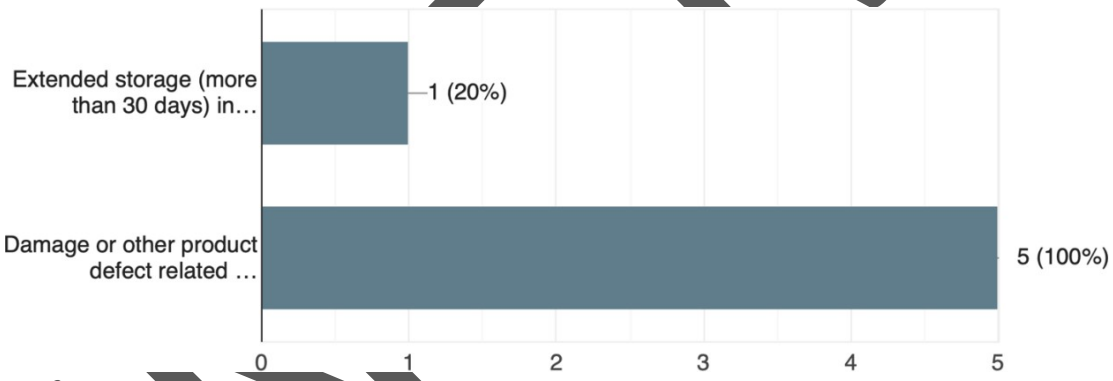
- As short as possible, but not longer than four weeks.

Please describe any particular precautions or preparatory actions you would highlight to the recipient if they decide to store the ITNs in containers upon delivery? [1 response]

- Put the containers in the shade.
- We do strongly recommend NOT to store the ITNs in containers

Would your product warranty cover: [6 responses]

a. Extended storage (more than 30 days) in containers at delivery or other levels?
b. Damage or other product defect related to ITNs not being stored in individual packaging?



Are there any additional packaging or storage conditions that would make your warranty null and void? [5 responses]

- Storage in hot, wet, or high humidity for extended periods of time.
- No.
- Storage under direct sunlight or in temperatures exceeding 40^{O}C for more than eight weeks.
- N/A.
- High temperature and humidity, exposure to sunlight.

AMP wishes to extend its gratitude to the following manufacturers who took part in the survey:

- A to Z Textile Mills Ltd
- BASF SE
- Disease Control Technologies LLC

- Life Ideas Biological Technology Co. Ltd
- Mainpol GmbH
- Shobikaa Impex Private Ltd
- Sumitomo Chemical Co. Ltd
- Tianjin Yorkool International Trading Co. Ltd
- Vestergaard S.A.
- VKA Polymers Pvt. Ltd