



REDUCING DEATHS AND  
SUFFERING FROM TROPICAL  
DISEASES

# The PermaNet Dumuria ®

# The LLIN - Does 'one net fit all'?



# What about in these contexts?



Refugees from Nigeria, UNHCR photo, 2019



Refugees from Agadez, Niger  
UN photo, 2018



Somalian IDPs, UN photo, 2017

# Or in this context? - Nomadic Populations (Estimated 50-217 million)

- Groups of people with '**no fixed home** who move according to the seasons and in search of water, food, and pasture'
- Over 60% Nomadic Populations found in Africa



# Nomadic populations are vulnerable

- Many live in harsh, semi-arid regions of Africa in malarious zones
- Reduced access to healthcare
- Often sleep outdoors or under temporary shelter
  - Unprotected by existing vector control tools; IRS and LLINs are both for indoor use
- Rising reports of exophagic behaviour among malaria vectors

Exposed to greater risk of malaria morbidity and mortality



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# The Dumuria Net (PermaNet® Dumuria)

(Based on PermaNet® 2.0)



## Key Differences:

- Non-mesh
- Opaque
- Bed-sheet like fabric
- UV protectants added to the insecticide in the net



# Study - Dumuria Nets for protection of nomadic populations in Garissa, Kenya

**Aim:** To determine the suitability of Dumuria Nets among vulnerable nomadic populations in harsh environments

- **Primary Objective:** To determine the acceptability of the Dumuria nets
- **Secondary Objective:** To determine the retention, utilisation and durability of the Dumuria Nets



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# Garissa County

In Garissa County, outside of cities and large towns, 60% of the population are nomadic



Nomadic populations live in harsh, semi-arid conditions where malaria transmission is seasonal and epidemic prone

# Nomadic populations - Garissa, Kenya

- Individuals choose to sleep outside or under shelters (observations made during study)
- Never before used/seen LLINs in this location
- All vectors in area have been shown to exhibit both exophagic and exophilic behaviours
- No recorded pyrethroid resistance of mosquitoes



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# Trial Design

- In September 2011, 13,922 Dumuria nets were distributed to 8,511 'households' across Garissa
- IEC given to encourage correct usage and prioritisation of use by those most vulnerable (<5 yrs and pregnant women)



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## First Objective - Acceptability

**Why is there a need for acceptability?**



## Objective 1 - Acceptability Study - Longitudinal study with cross-sectional surveys.

At months 6, 12, 18 and 22, 300 randomly selected households were visited, and questionnaires administered (in Somali).

- Questions on: net status, use and handling.

At month 1 and 22, focus group discussions and key informant interviews were conducted

- A range of open-ended questions which participants could respond freely to



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Acceptability, utilization, insecticidal activity and physical integrity were assessed at months 6, 12, 18, and 22 and net retention at months 18 & 22

Processes used:

WHO LLIN durability test

WHO blind bio-efficacy, knockdown (KD-60)

& total mortality test

WHO net retention rates

Analysis with SPSS and Stata

## Key Findings:

95.3% of respondents liked Dumuria

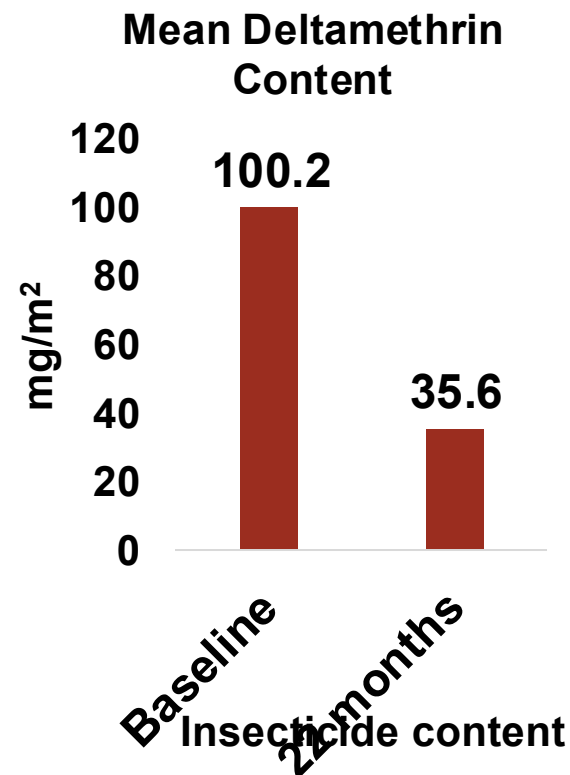
58.1% liked the size of the nets

35.6% liked the fabric

33.6% liked the shape

After 18 months 100% of Demuria had at least

WHOPES-acceptable levels of insecticide



Malaria Journal 2015 Feb;14:52. DOI: 10.1186/s12936-015-0546-1



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## Objective 1 - Acceptability, Concerns

58.8% of respondents reported some sort of concern:  
(67.6% of population responded)

Concern	Respondents reporting concern (%)	95% confidence interval
Colour	47.1	43.1, 51.0
Heat/ventilation	26.6	23.3, 30.0
Shape	20.0	17.0, 23.3
Size	5.4	3.8, 7.4
Fabric and washing	0.5	0.2, 1.4

## Concerns - Colour vs Heat



## Objective 2 - Physical Condition and utilisation of Dumuria net, by longitudinal, cross sectional surveys

At months 6, 12, 18 and 22, from 300 households surveyed, 30 nets were randomly selected and sent to be tested

**Durability** - Holes (Size, Quantity and Position) recorded

**Bioefficacy and insecticide content** recorded

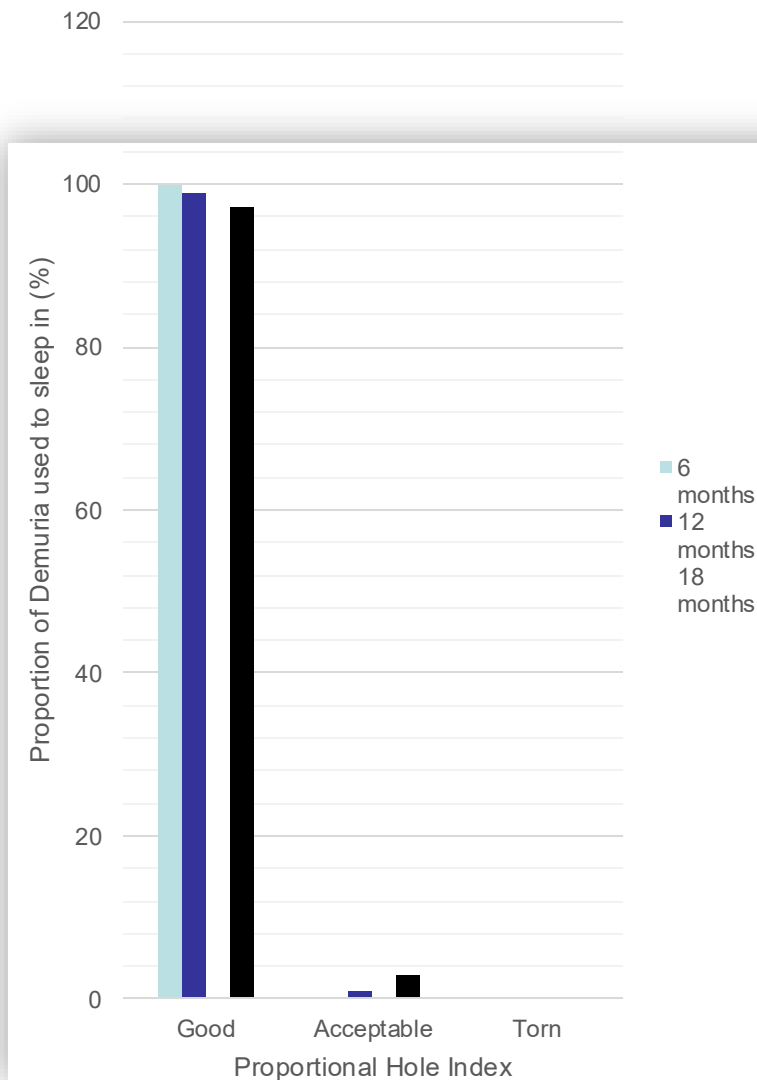
**Utilisation** - Information collated about net use from questionnaires

At month 18 and 22, selected populations were surveyed for net **retention**



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## At 22 months post-distribution:

97.1% of nets were in the WHO category of being in “good” condition; none were in the “torn” category.

66.7% had WHOPES acceptable levels of insecticide

Retention was 98%.

Cumulative attrition rate was 1.9%.

95.3% of the study pop. said they liked the nets.

98.4% used for sleeping under (60.8% every night and 74.1% all year round).

For 2013, MoH reported a reduction of 92% in suspected and confirmed malaria cases in Garissa compared to 2010

[Am J Trop Med Hyg. 2015 Nov;93\(5\):1002-1009. 10.4269/ajtmh.14-0458.](http://ajtmh.14-0458)



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# Durability - Holes

Multivariate logistic regression models produced 4 possible predictors of the development of holes

1. Using an open flame for heating, cooking or lighting
2. Taking net away from home, to a farm hut or the forest
3. Time
4. If the net was found outside at the time of the survey

Factors can be used to develop IEC

Variable	OR (95% CI)	P
Months	1.07 (1.00, 1.1)	0.042
Net used away from home		
Not used away	Baseline	–
Taken to farm hut	13.7 (3.1, 61.1)	0.001
Taken to forest	3.3 (1.4, 8.0)	0.008
Where net found at time of survey		
Found inside	Baseline	–
Found outside	2.3 (1.5, 3.6)	0.001
Use of an open flame		
Open flame not used	Baseline	–
Open flame used	6.30 (3.0, 13.1)	0.001

CI = confidence interval; OR = odds ratio.

## Bioefficacy and Insecticide content

**Bioefficacy** - in terms of knock-down (KD-60) and total mortality, tested using a standard cone test

Test	Measure	Baseline	6 months ( <i>N</i> = 29)	12 months ( <i>N</i> = 30)	18 months ( <i>N</i> = 30)	22 months ( <i>N</i> = 30)
Passed either WHO cut off (%) (KD-60 ≥ 95% or total mortality ≥ 80%)		100		96.7 (82.8, 99.9)	100	66.7 (47.2, 82.7)

**Insecticide content** - quantifying active ingredient per gram of Dumuria Net

- At 22 months, mean content was 35.6(mg/m<sup>2</sup>), a fall of 64% from the baseline mean of 100.2

# Net retention and attrition (at month 22)

Retention rates:

$$\text{Retention} = \frac{\text{No. of houses with net present and available to sleep under}}{\text{Total no. of households sampled}} \times 100 = 98\%$$

Attrition rates:

$$\text{Attrition rate 1} = \frac{\text{No. of houses with net reported lost due to wear and tear}}{\text{Total no. of households sampled}} \times 100 = 0.3\%$$

$$\text{Attrition rate 2} = \frac{\text{No. of houses with net given away, stolen, sold or used elsewhere}}{\text{Total no. of households sampled}} \times 100 = 1.3\%$$

$$\text{Attrition rate 3} = \frac{\text{No. of houses with a net reported used for other purposes}}{\text{Total no. of households sampled}} \times 100 = 0.3\%$$

# Net Utilization - Where, when, how, how often?

## Q How often?

- 98.4% reported using the net for sleeping
- 60.8% reported using the net every night
- 0.4% reported not using the net at all

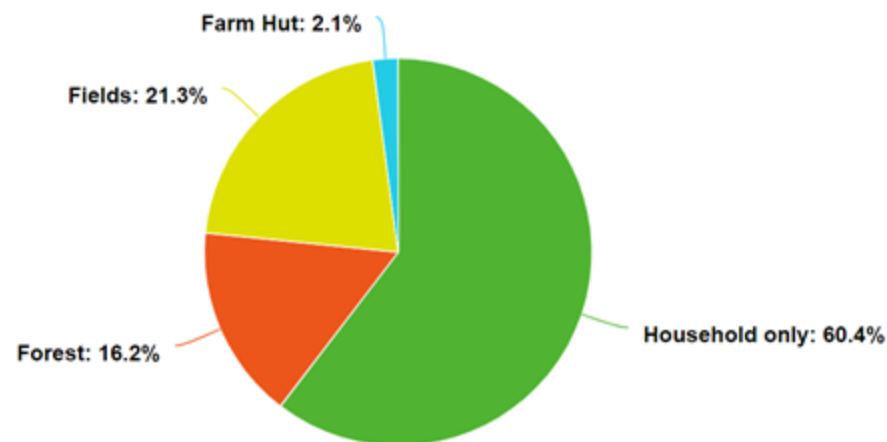
## Q How?

86.5% tuck their net under a sleeping mat during use  
52.8% wash their nets

## Q When?

74.1% all year round  
25.2% only during rainy season

## Q Where?



# Overview

## Objective 1 - Acceptability

High acceptability (95.3% liked the nets) ✓

## Objective 2 - Physical condition and Utilization

At 22 months

- High retention and low attrition (98% retention) ✓
- High durability (only 15.5% with at least one hole, 0% in the torn category) ✓
- High utilisation (98.4%) ✓
- High bioefficacy (100% passed WHO cut off at 18 months - only dropping to 66.7% at 22 months) ✓



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# ‘One net fits all’ OR context specific LLINs



Large-scale blanket  
distribution  
campaigns



Context specific LLINs,  
taking into account  
nuanced needs and  
preferences of  
communities