ADVANCES IN MALARIA PREVENTION AND VECTOR CONTROL

Insecticide Treated Plastic Sheeting

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Durable Lining

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Insecticide Treated Plastic Sheeting (ITPS)

Duel purpose tool to:

- Save delivery time
- Reduce dependency on specialised control teams
- Improve acceptability and compliance and target whole household (like IRS)
- Long lasting
- Cost effective: shelter & malaria control

ITPS Evidence

	Country	Year	Author	Journal	Title
1	-	2002	Graham K, et al.	Med Vet Entomol	Insecticide-treated plastic tarpaulins for control of malaria vectors in refugee camps
2	-	2003	Allan R, et al.	International Aid and Trade Journal	Motivating the private and public sector to establish common goals
3	-	2003	Allan R, et al.	PATH Canada Journal	Waging war on malaria
4	-	2004	Graham K, et al.	Journal Royal Soc Promo Health	New tools to control malaria in refugee camps
5	-	2004	Allan R & Burnham G	Lancet– Extreme Medicine	Medicine for Refugees, 2004
6		2005	Burns M	Humanitarian Exchange	Evaluating insecticide-treated polyethylene sheeting for malaria control in complex emergencies: an intersectoral approach
7	Indonesia	2005	Allan R & Muriuki D	Humanitarian Exchange	Emergency malaria and dengue fever control: lessons from the tsunami in Aceh
8	-	2005	WHO	-	Guidelines for control of communicable diseases in the tsunami
9	Burkina Faso	2006	Diabate A, et al.	Trop Med Int Health	The indoor use of plastic sheeting pre-impregnated with insecticide for control of malaria vectors
10	Benin	2009	Djenontin A, et al.	Malar Journal	Managing insecticide resistance in malaria vectors by combining carbamate-treated plastic wall sheeting and pyrethroid-treated bed nets

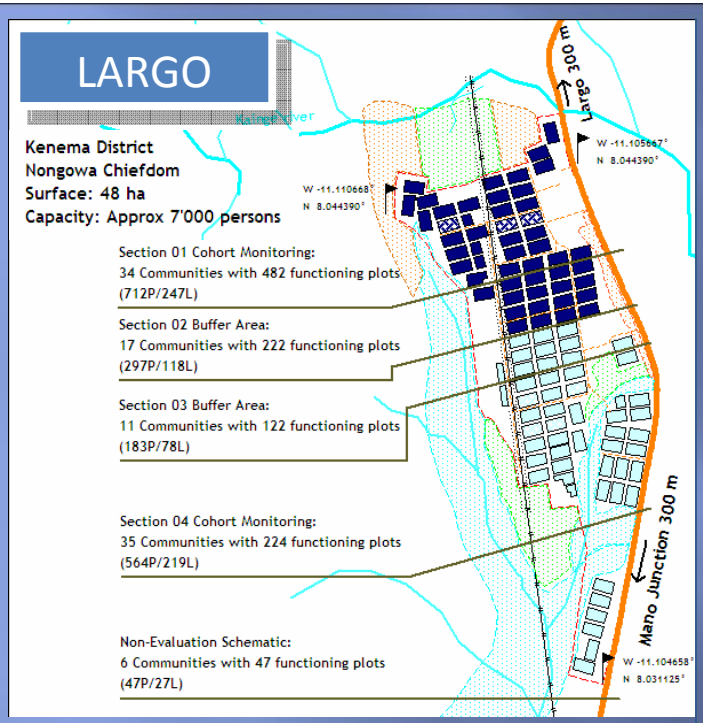
	Country	Year	Author	Journal	Title
11	India	2009	Sharma SK	Indian Journal Med Research	Field evaluation of ZeroFly--an insecticide incorporated plastic sheeting against malaria vectors & its impact on malaria transmission in tribal area of northern Orissa
12	Burkina Faso	2010	Djenontin A, et al.	Am J Trop Med Hyg	Indoor use of plastic sheeting impregnated with carbamate combined with long-lasting insecticidal mosquito nets for the control of pyrethroid-resistant malaria vectors
13	Burkina Faso	2010	Chandre F	Parasites & Vectors	Field efficacy of pyrethroid treated plastic sheeting (durable lining) in combination with long lasting insecticidal nets against malaria vectors
14	Ghana	2010	Stiles-Ocran J, et al.	Int J Infect Dis	Field evaluation of ZeroVector™ DurableL ining as an alternative to indoor residual spraying (IRS) for the control *Anopheles* vectors of malaria in rural villages of Obuasi, Ghana
15	India	2011	Mittal PK, et al.	Journal of Vector Borne Diseases	Evaluation of the impact of ZeroFly(R), an insecticide incorporated plastic sheeting on malaria incidence in two temporary labour shelters in India
16	-	2011	WHO	-	Public health risk assessment and interventions, The Horn of Africa: Drought and famine crisis
17	Sierra Leone	2012	Burns M, et al.	Am J Trop Med Hyg	Insecticide-treated plastic sheeting for emergency malaria prevention and shelter among displaced populations: an observational cohort study in a refugee setting in Sierra Leone
18	Angola	2012	Brosseau L, et al.	PLoS One	Human antibody response to *Anopheles* saliva for comparing the efficacy of three malaria vector control methods in Balombo, Angola

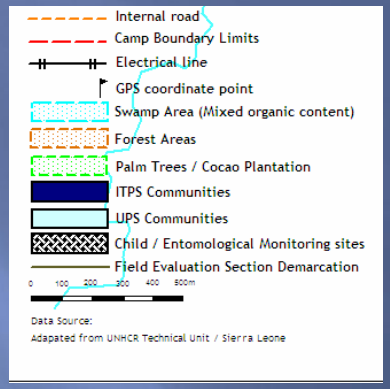
	Country	Year	Author	Journal	Title
17	Sierra Leone	2012	Burns M, et al.	Am J Trop Med Hyg	Insecticide-treated plastic sheeting for emergency malaria prevention and shelter among displaced populations: an observational cohort study in a refugee setting in Sierra Leone

- **STUDY DESIGN**: Double-blind phase III trial using ITPS or untreated polyethylene sheeting (UPS) randomly deployed to defined sectors of two camps. Buffer section demarcation included. Refugees treated with ACT to clear all malaria infections. Children up to 3 years of age monitored for 8 months

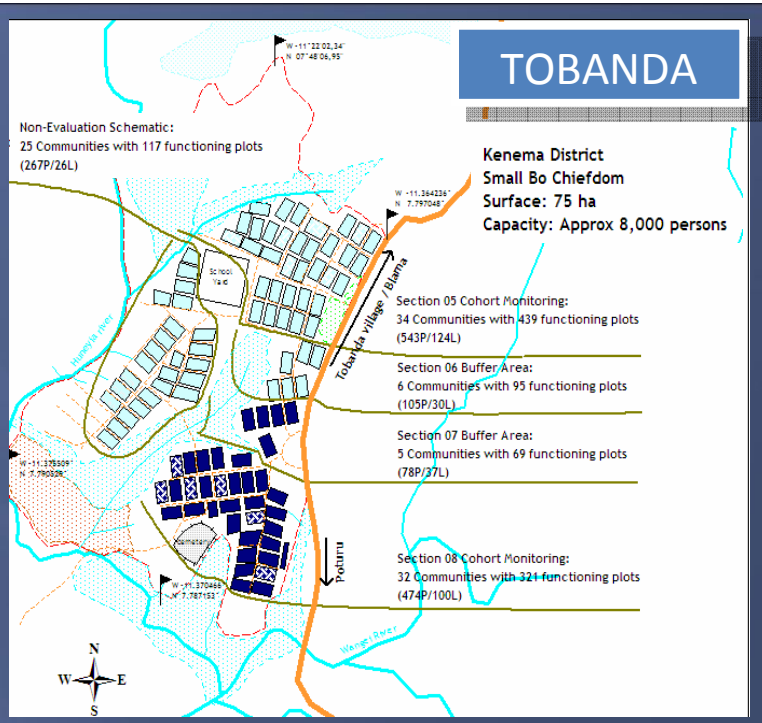
  - Largo: Plots fully lined - inner walls and ceilings (mimics acute phase emergency where ITPS used as tent or for shelter)
  - Tobanda: Plots partially lined – ceiling and/or roof only (mimics chronic phase emergency when more permanent shelter made from local materials)

Source: Burns et al. 2012





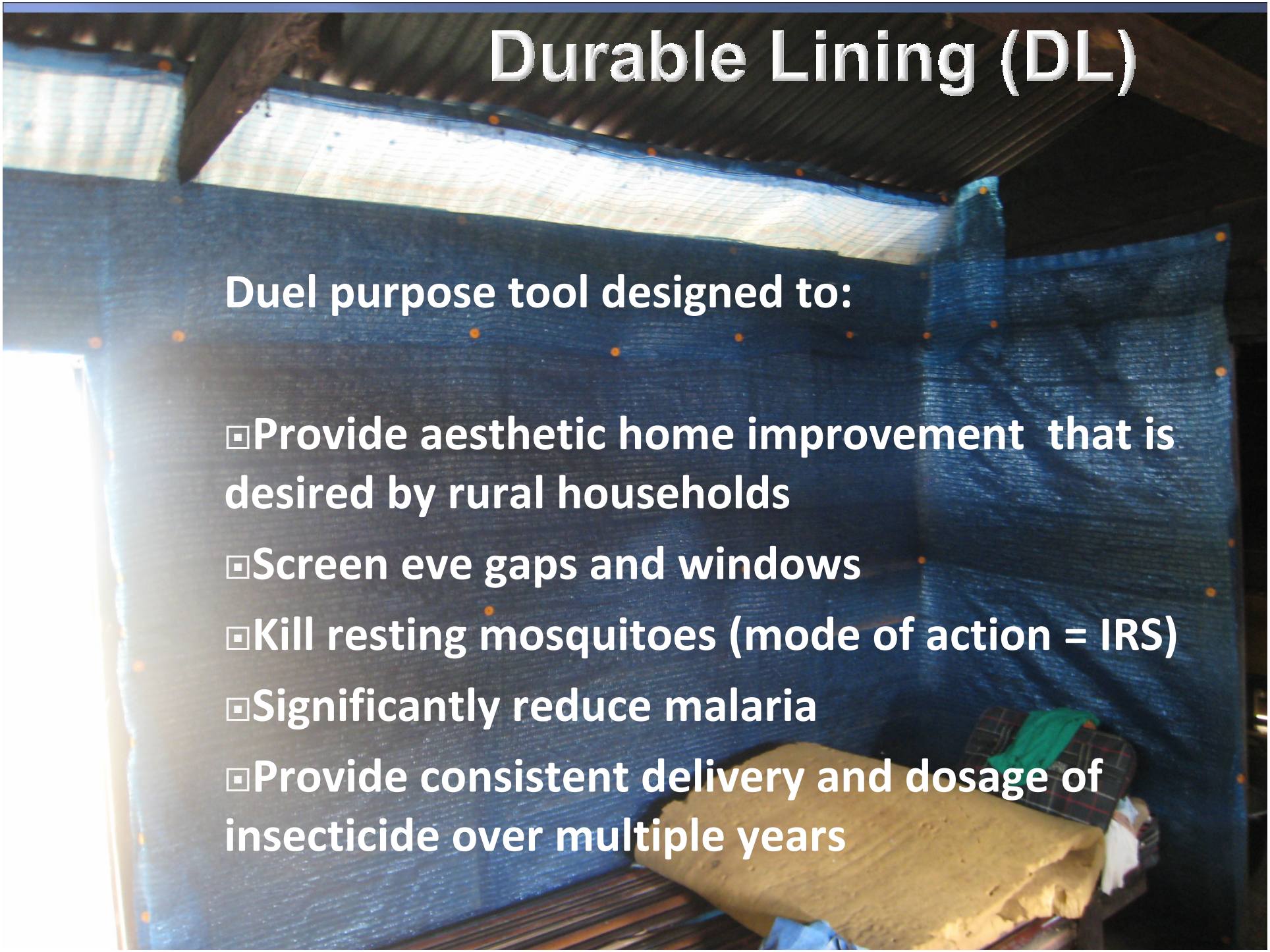
Source: Burns et al. 2012



STUDY OUTCOMES:

Refugee camp	Coverage	Pf incidence rate (per 100 person-years)		Protective efficacy of ITPS
		ITPS	UPS	
Largo	Full (inner wall and ceiling)	63	163	61%
Tobanda	Partial (ceilings and/or roof)	134	157	15%

- Anemia rates: improved under ITPS in both camps.
- This novel tool proved to be a convenient, safe, and long-lasting method of malaria control when used as a full shelter lining in an emergency setting.



Durable Lining (DL)

Duel purpose tool designed to:

- **Provide aesthetic home improvement that is desired by rural households**
- **Screen eve gaps and windows**
- **Kill resting mosquitoes (mode of action = IRS)**
- **Significantly reduce malaria**
- **Provide consistent delivery and dosage of insecticide over multiple years**

DL Evidence

	Country	Year	Author	Journal	Title
1	*Laboratory*	2011	Achee NL, et al.	61st ASTMH meeting	Evaluation of ZeroVector® Durable Lining (DL) – impact on *Aedes aegypti* and *Anopheles stephensi* under varying DL coverage
2	Kenya	2011	Gimnig J	61st ASTMH meeting	Insecticide-treated wall liners reduce malaria transmission in Kenya
3	Papua New Guinea	2012	Pulford J, et al.	Malaria Journal	Feasibility and acceptability of DL for vector control in Papua New Guinea
4	Angola	2012	Brosseau L, et al.	PLoS One	Human antibody response to *Anopheles* saliva for comparing the efficacy of three malaria vector control methods in Balombo, Angola
5	Angola, Nigeria	2012	Messenger L, et al.	Malaria Journal	The development of insecticide-treated durable wall lining for malaria control: insights from rural and urban populations in Angola and Nigeria
6	Equatorial Guinea, Ghana, Mali, South Africa, Vietnam	2012	Messenger L, et al.	Malaria Journal	Multicentre studies of insecticide-treated durable wall lining in Africa and South-East Asia: entomological efficacy and household acceptability during one year of field use

	Country	Year	Author	Journal	Title
3	Papua New Guinea	2012	Pulford J, et al.	Malaria Journal	Feasibility and acceptability of DL for vector control in Papua New Guinea

- **STUDY DESIGN**:
  - Dl installed in 40 homes in 4 sites with different housing and transmission risk
  - Structure questionnaires and FGDs issued at installation and after 4 weeks

- **STUDY OUTCOMES:**
  - Despite some limitations, **DL found to be feasible and highly acceptable in a diverse range of PNG contexts and likely to be favorably received as a vector control intervention if accessible en masse.**

Source: Pulford et al. 2012

	Country	Year	Author	Journal	Title
6	Equatorial Guinea, Ghana, Mali, South Africa, Vietnam	2012	Messenger L, et al.	Malaria Journal	Multicentre studies of insecticide-treated durable wall lining in Africa and South-East Asia: entomological efficacy and household acceptability during one year of field use

- **STUDY DESIGN**:
  - DL compared to deltamethrin IRS in 220 rural households in 5 countries. Trial continued for 12 months at African sites (4) and 15 months at Asian site (1).
  - Bioefficacy and acceptability were evaluated via a standardized protocol.

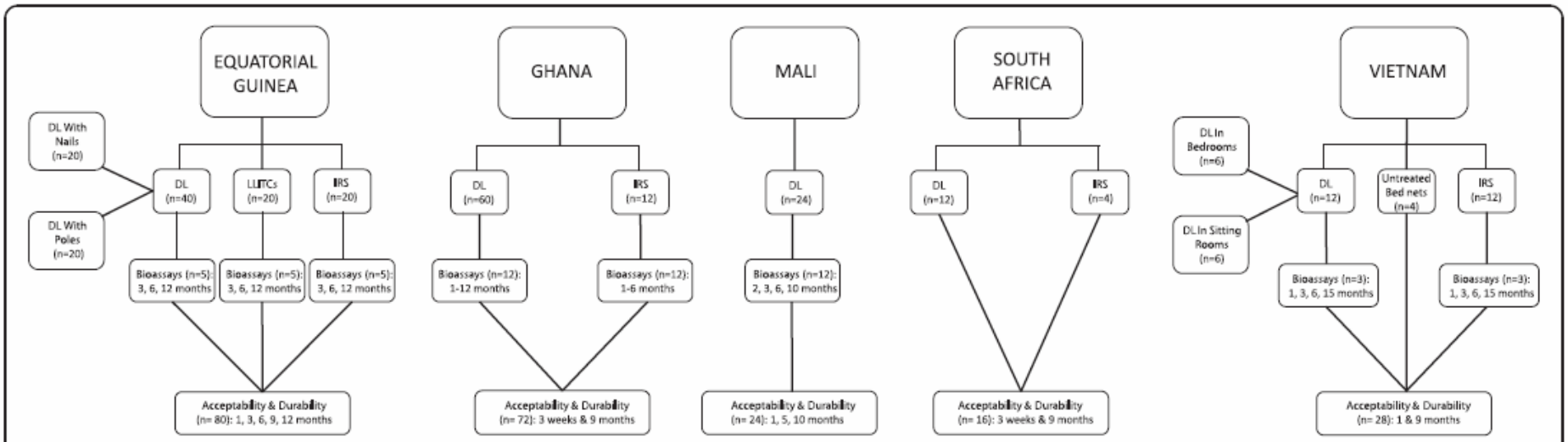


Figure 1 Study site profiles (n= number of households).

STUDY OUTCOMES :

Source: Messenger et al. 2012

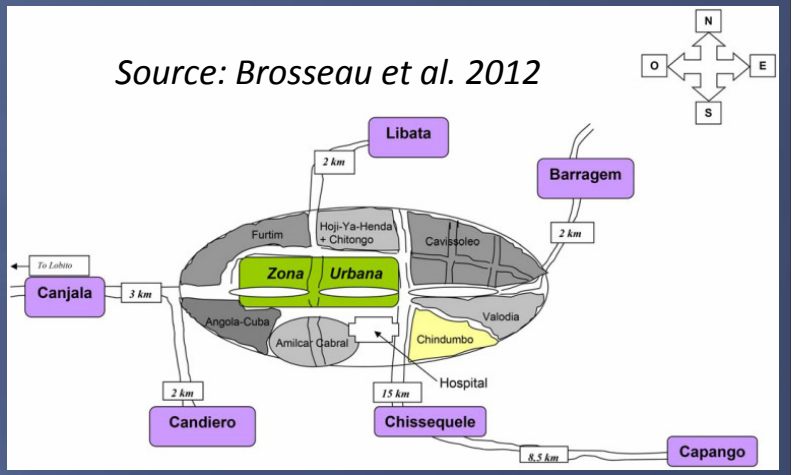
- **Bioefficacy:** DL showed little to no decline over 12-15m whereas IRS declined by 6 m with 100% loss by 12 m
- **Acceptability:** Householders perceived reductions in mosquito density (93%) and biting (82%), but no changes in indoor temperature (83%).
- For those wishing to retain DL, 73% cited protective reasons, 20% expressed a desire to keep for decoration and 7% valued both qualities equally.
- In Equatorial Guinea, DL consistently emerged as the most popular intervention regardless of the earlier household allocation.
- **Just as LLINs overcame several of the technical and logistical constraints associated with conventionally treated nets and then went to scale, this study demonstrates the potential of DL to sustain user compliance and overcome the operational challenges associated with IRS.**

	Country	Year	Author	Journal	Title
4	Angola	2012	Brosseau L, et al.	PLoS One	Human antibody response to *Anopheles* saliva for comparing the efficacy of three malaria vector control methods in Balombo, Angola

STUDY DESIGN:

- 6 paired villages (4150 people) received either LLIN + ITPSDL or IRS.
- Pre- and post-intervention monitoring every 2 months (2008-2009) for:
  1. Entomological impact via CDC light trap collections with molecular identifications and *Plasmodium* infection rates
  2. Human parasitological impact (infection status, *Plasmodium* species, and parasiteamic load) of 2 – 9 year olds via thick blood smears
  3. Human immunological impact via human antibody (Ab) response to *Anopheles* whole saliva (used as biomarker of *Anopheles* exposure)

Source: Brosseau et al. 2012



STUDY OUTCOMES

- The three vector control interventions resulted in significant decreases in entomological and parasitological indices from 2008-2009:

REDUCTIONS IN INDICES	DL (Chissequele)	LLIN + ITPS (Capango)	IRS (Libata)
Anopheles densities	73%	82%	78%
Human infections (proportion of positive blood smears)	51%	58%	54%

- There was an association between entomological /parasitological data and anti-*Anopheles* saliva IgG
- Based on the three criteria measured, the combined use of LLIN and ITPS proved even more effective than the use of one vector control method alone, either DL or IRS

Next:

Phase III DL studies in 2013:

Tanzania (DL 1st generation)

Liberia (DL 2nd generation)

THANK YOU