



a decade in communicable disease control and child health

# Trends in Malaria Prevalence and Net Coverage : Cambodia 2004-2010

Arantxa Roca-Feltrer and Sarala Nicholas

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# Background and objectives

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## Cambodia Malaria Surveys (CMS)

- large-scale national surveys (household, drug, net outlet, health facility) to monitor and evaluate the performance and impact of CNM's malaria control activities
- conducted in 2004, 2007, 2010, 2013

Here, we describe the trends between 2004-2010 in

- Malaria prevalence (blood slide and PCR)
- Net coverage
- Net use

**And very preliminary  
results of CMS2013!**

# Comparability of surveys for trend analysis

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## Similarities

### Design:

X-sectional two-stage cluster HH survey stratified by geographical domain and risk zone

### Sampling

1st stage: Risk villages sampled using PPS

2nd stage: HHs sampled using SRS

### Timing:

during peak malaria season every 3 years

### Tools:

standardised questionnaires

## Differences

Geographical domain and number of provinces

Risk zone definition (<2km or <5km from forest)

# Changes of domains and risk strata over time

**CMS2004**  
N=23

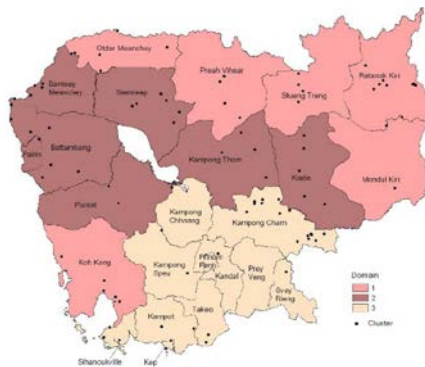
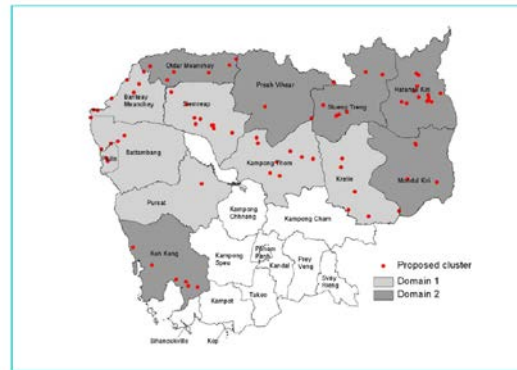


Figure 3.3 Selected Clusters by Domain

**CMS2007**  
N=13



**CMS2010**  
N=20



**Table 3.2** Distribution of Provinces by Domain

1. Northeast + Koh Kong	2. North West and Central	3. South East
Koh Kong MondulKiri Oddar Meanchey Preah Vihear Rattanakiri Stung Treng	Banteay Meanchey Battambang Kampong Thom Kratie Pailin Pursat Siemreap	Kampong Cham Kampong Chhnang Kampong Speu Kampot Kandal Kep Prey Veng * Sihanoukville Svay Rieng Takeo

Although Prey Veng was included in the sampling frame, it did not have any clusters selected.

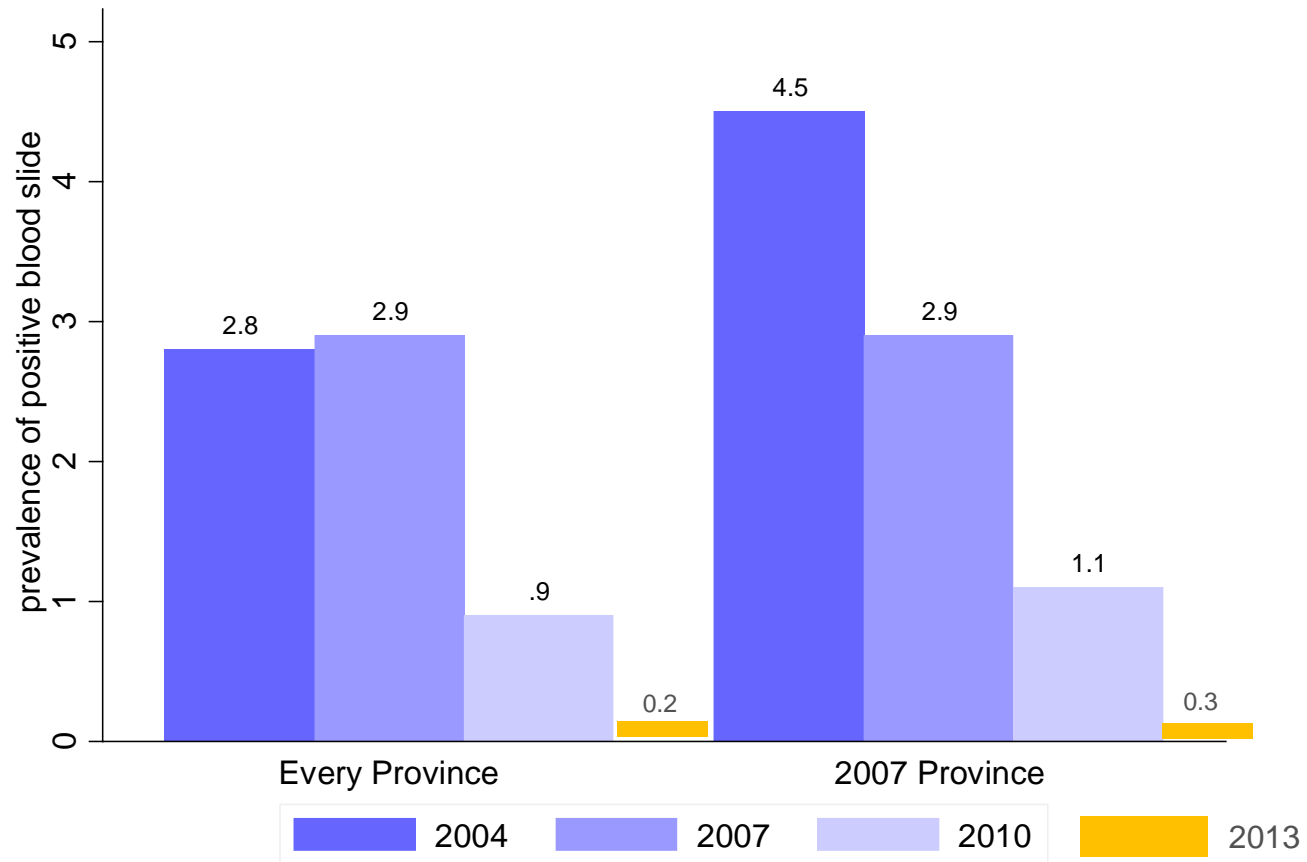
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**Table 1b.** Distribution of Provinces in the two geographical Domains

Domain 1 (West – Containment areas)	Domain 2 (East and South)
Banteay Meanchey	Kampong Cham
Battambang	Kampong Chhnang
Kampong Speu	Kampong Thom
Kampot	Kep
Koh Kong	Kratie
Oddar Meanchey	MondulKiri
Pailin	Rattanakiri
Preah Vihear	Sihanoukville
Pursat	Stung Treng
Siem Reap	Takeo

# Implication of differences in trend analysis



# Study population

	2004	2007	2010
	N (%)	N (%)	N (%)
<b>Total Households</b>	<b>3290</b>	<b>2270</b>	<b>3164</b>
Nearness to Forest			
1 (nearest)	1535(24.2)	770 (21.3)	1417 (34.1)
2	914 (42.3)	861 (45.7)	955 (39.2)
3 (furthest)	841 (33.5)	639 (33.0)	792 (26.7)
Socio-Economic Status			
Q1 (poorest)	668 (17.9)	505 (22.9)	690 (19.9)
Q2	666 (18.0)	462 (20.1)	637 (20.2)
Q3	651 (19.2)	461 (19.2)	637 (20.5)
Q4	648 (21.5)	447 (19.1)	603 (19.3)
Q5 (least poor)	646(23.4)	395 (18.6)	597 (20.1)
Region			
Eastern	892 (23.0)	1223 (50.3)	911 (28.1)
Western	1367 (40.5)	1047 (49.7)	1258 (41.1)
Central	1031 (36.5)		995 (30.8)
<b>Total Individuals</b>	<b>17325</b>	<b>11342</b>	<b>16462</b>
Age/Sex			
Under 5's	2031 (17.6)	1399 (19.1)	1748 (17.6)
5 to 14 year olds	4979 (31.6)	3046 (31.6)	4157 (30.1)
Male adults 15+years	4947 (25.5)	3310 (25.1)	5160 (26.8)
Female adults 15+ years	5368 (25.4)	3587 (24.2)	5397 (25.4)
Blood samples taken			
Microscopy	8247	6274	9093
PCR		5965	8768

## Risk Zone Codes

### 2004/2007

- 1 <=250m
- 2 >250 m and <1km
- 3 >=1 km and <2km

### 2010

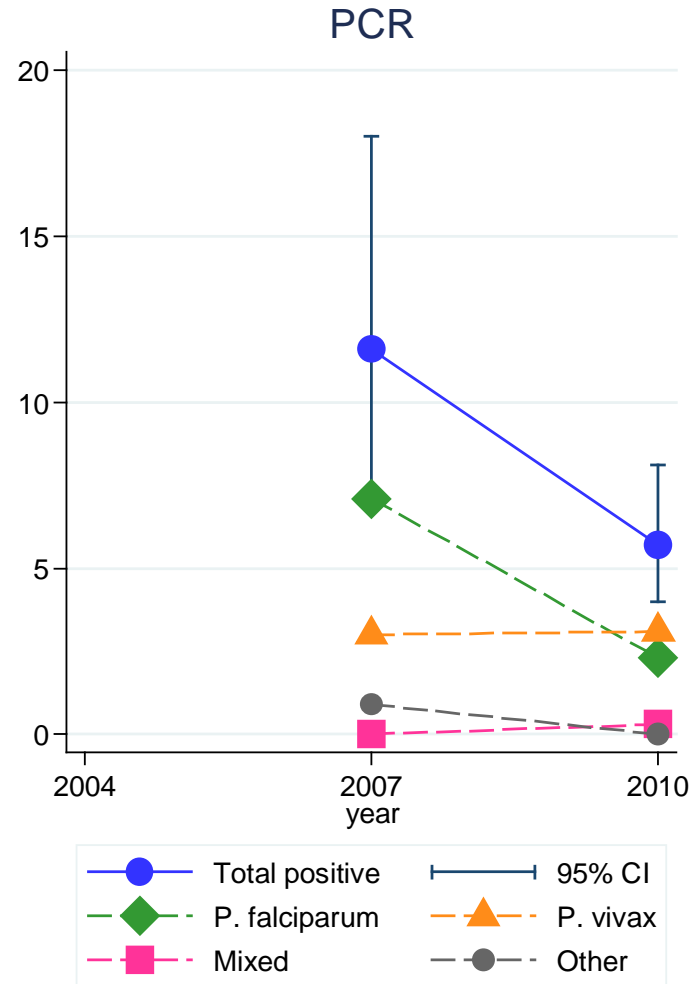
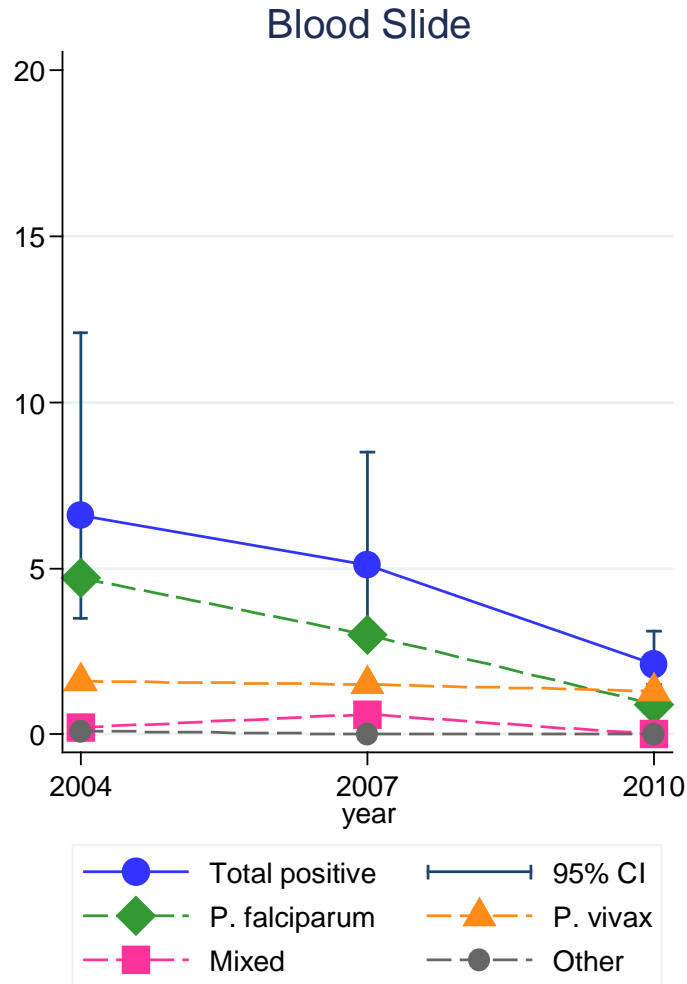
- 1 <=500m
- 2 >500 m and <1km
- 3 >=1 km and <2km



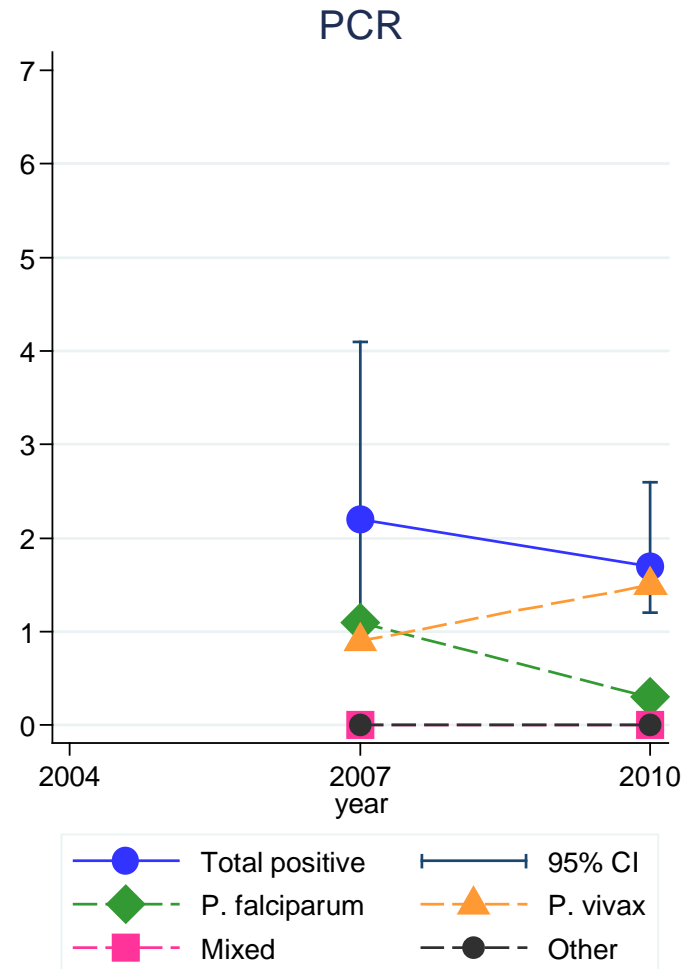
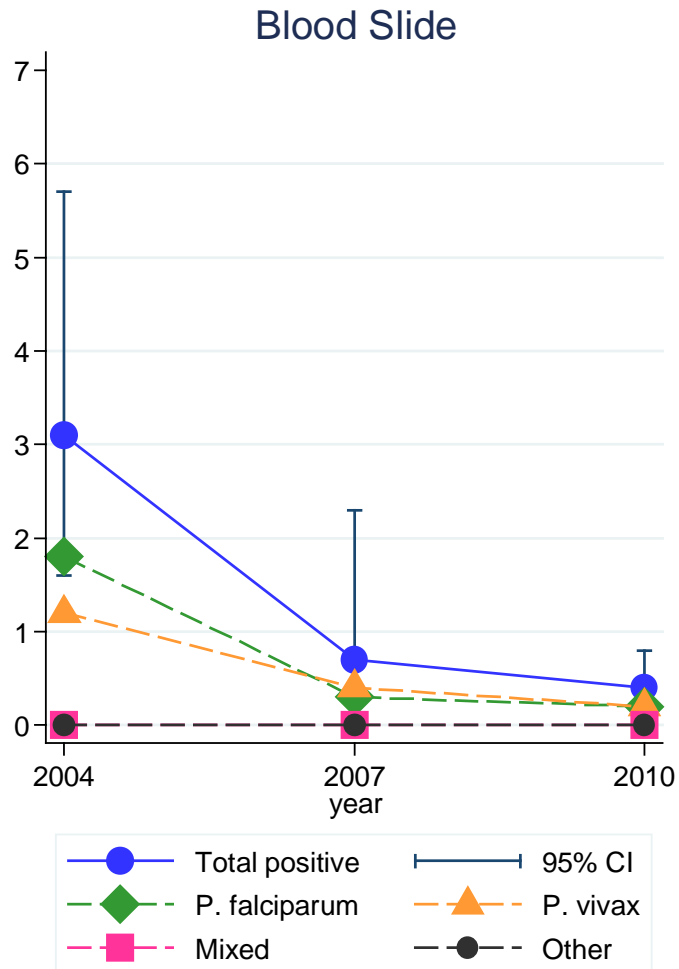
## Trends

- 1 <=250m /<=500m
- 2 >500 m/>=250m and <1km
- 3 >=1 km and <2km

# Prevalence – Eastern Region

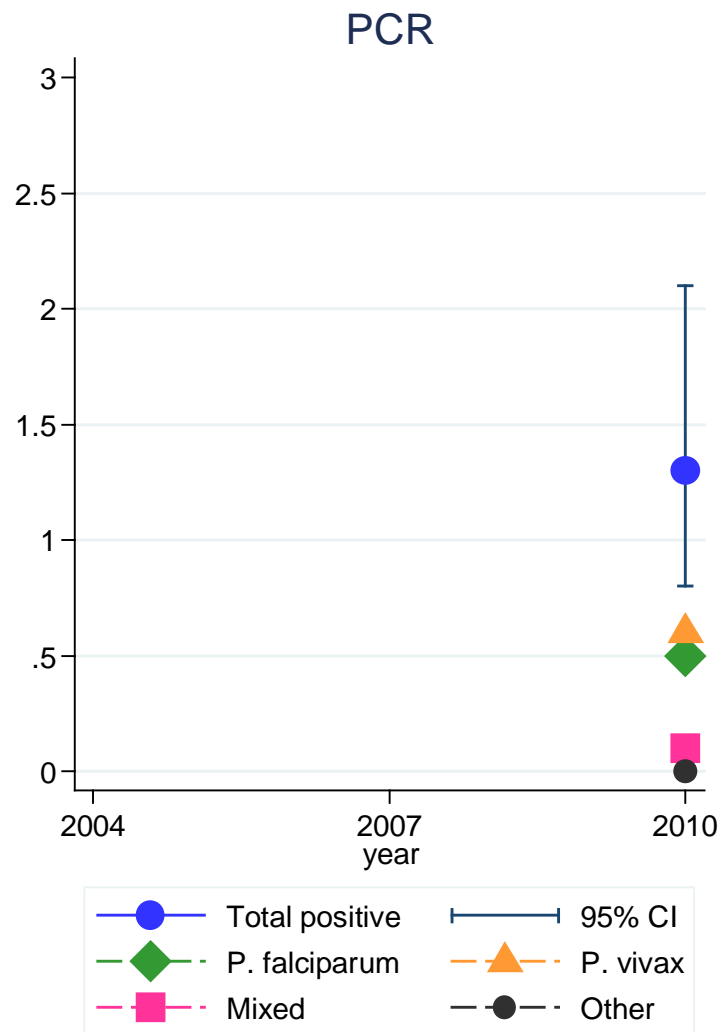
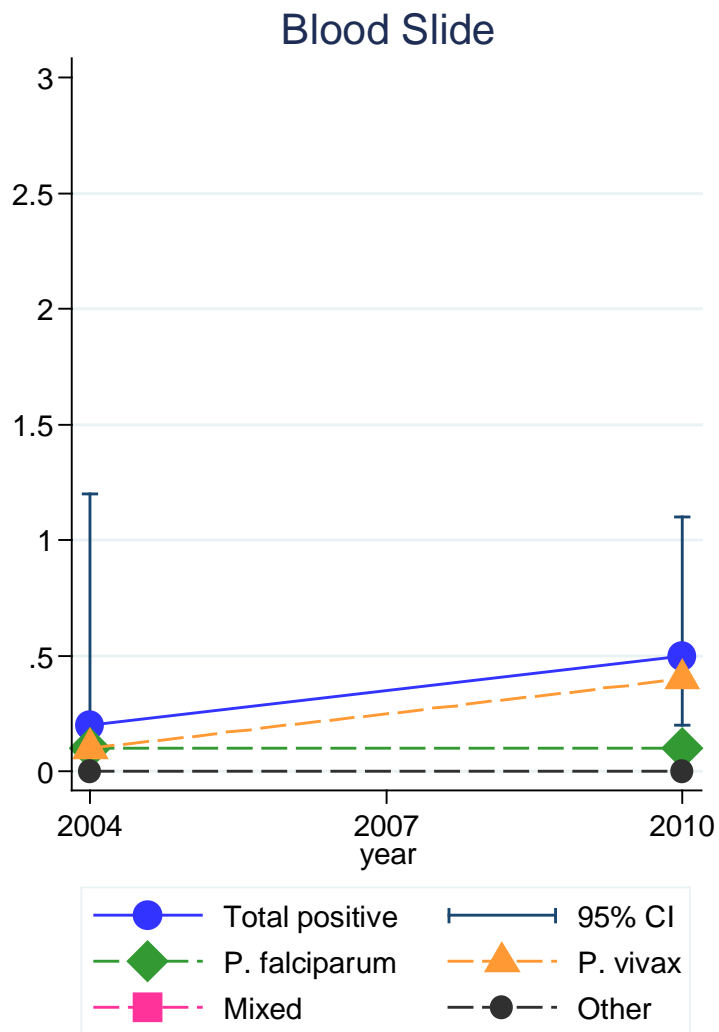


# Prevalence – Western Region

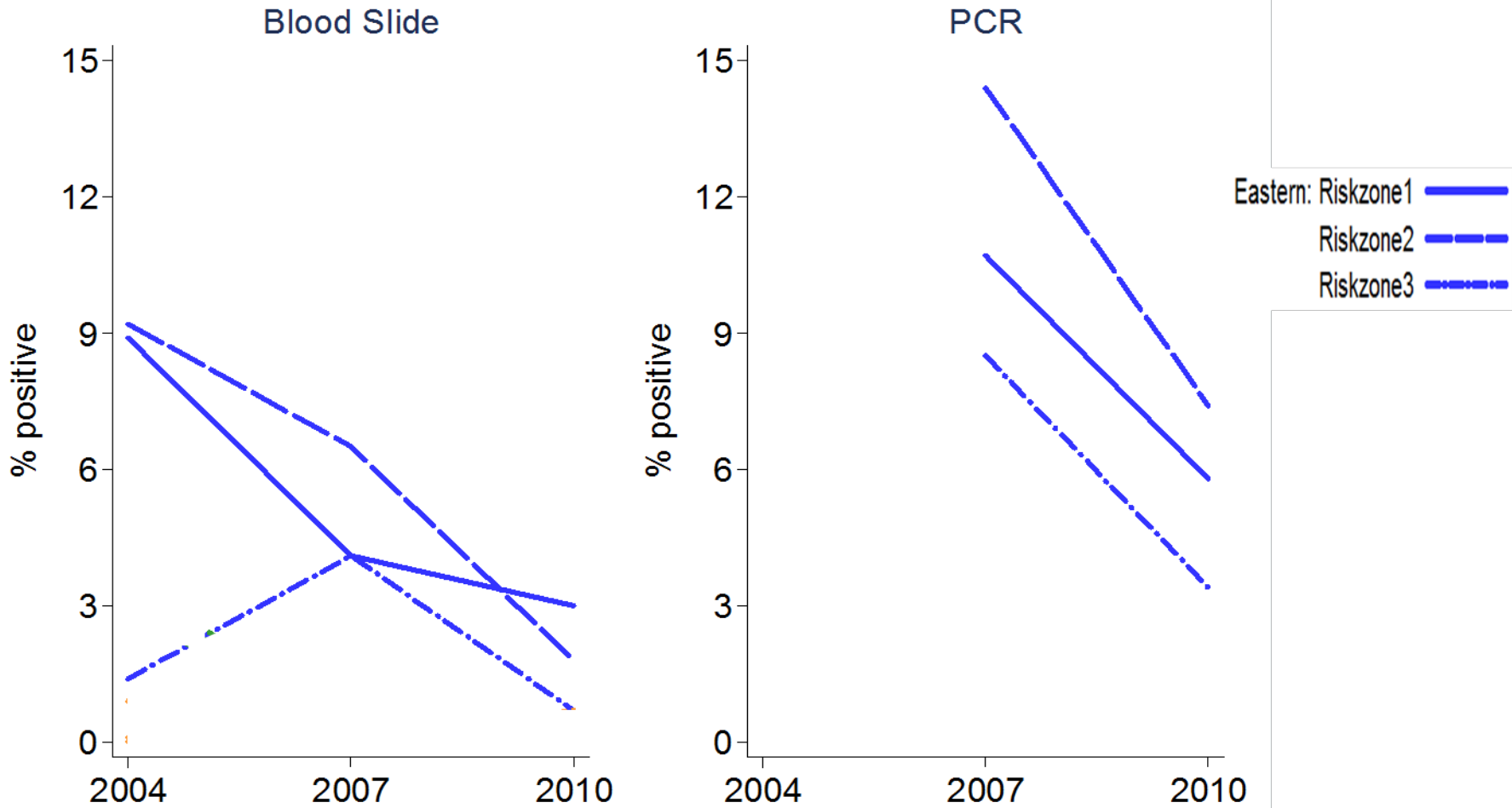




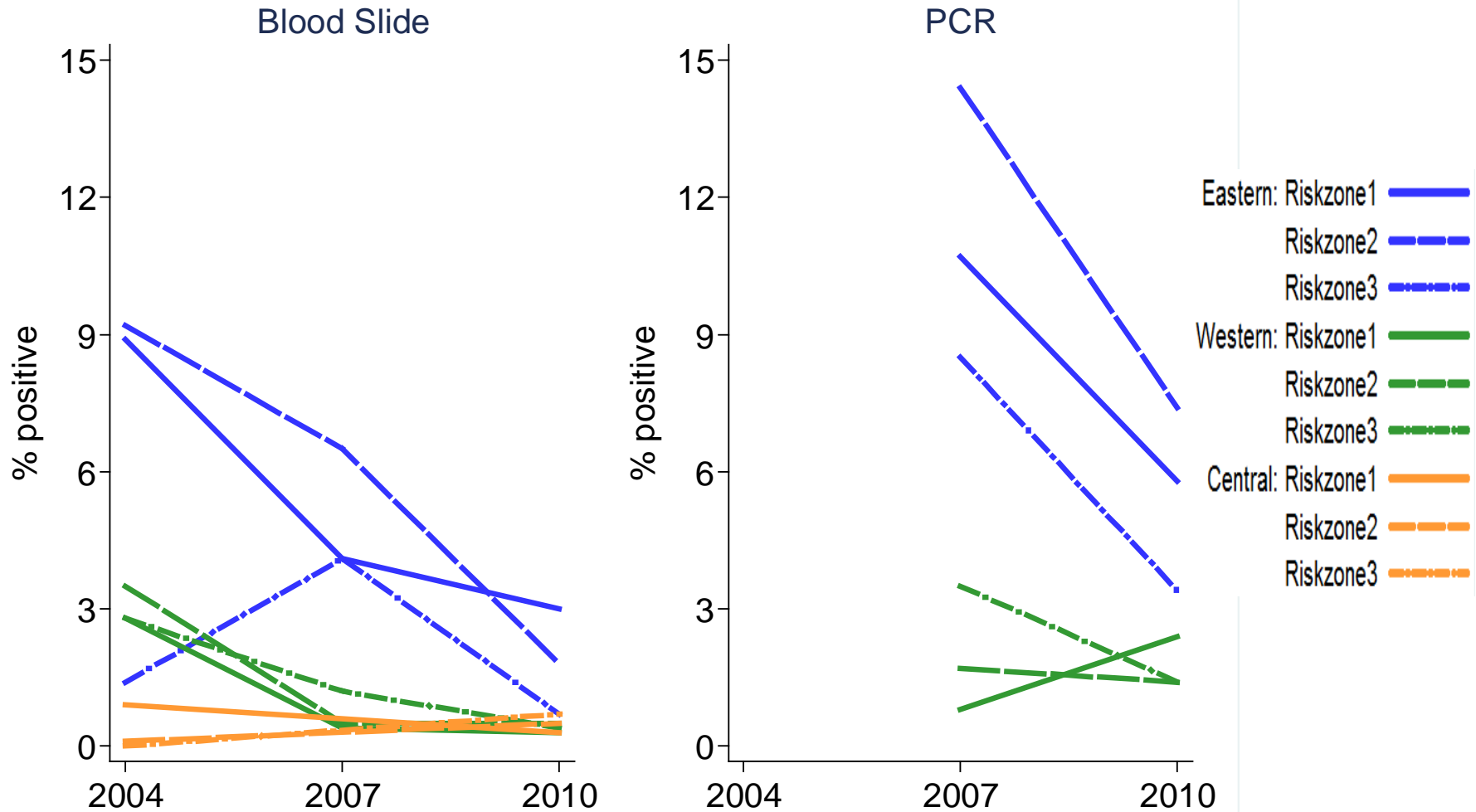
# Prevalence – Central Region



# Prevalence by risk zone



# Prevalence by risk zone



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# Trends Eastern Region

	<b>2004</b> % [95% CI]	<b>2007</b> % [95% CI]	<b>2010</b> % [95% CI]	<b>Trend</b> p-value
Positive Blood Slide	6.6 [3.5,12.1]	5.1 [3.0,8.5]	2.1 [1.5,3.1]	<0.01
Positive PCR		11.6 [7.2,18.0]	5.7 [4.0,8.1]	0.02
Household ownership of nets	93.3 [87.6,96.5]	96.2 [91.5,98.3]	99.3 [98.1,99.7]	<0.01
Household ownership of ITNs	22.3 [12.4,36.7]	59.8 [50.1,68.7]	77.8 [68.9,84.7]	<0.01
Household ownership of LLINs		27.8 [18.3,39.8]	70.6 [60.0,79.3]	<0.01
Sufficient ITNs	8.1 [4.3,14.7]	22.0 [17.5,27.4]	37.4 [29.6,46.0]	<0.01
Sufficient LLINs		6.9 [4.8,9.7]	31.1 [24.3,38.9]	<0.01
Slept under any net last night	72.9 [63.3,80.8]	76.5 [70.3,81.7]	87.9 [84.1,90.8]	<0.01
Slept under ITN	15.4 [7.7,28.4]	38.3 [30.2,47.1]	56.8 [46.5,66.5]	<0.01
Slept under LLIN		14.8 [9.3,22.7]	47.6 [37.2,58.2]	<0.01

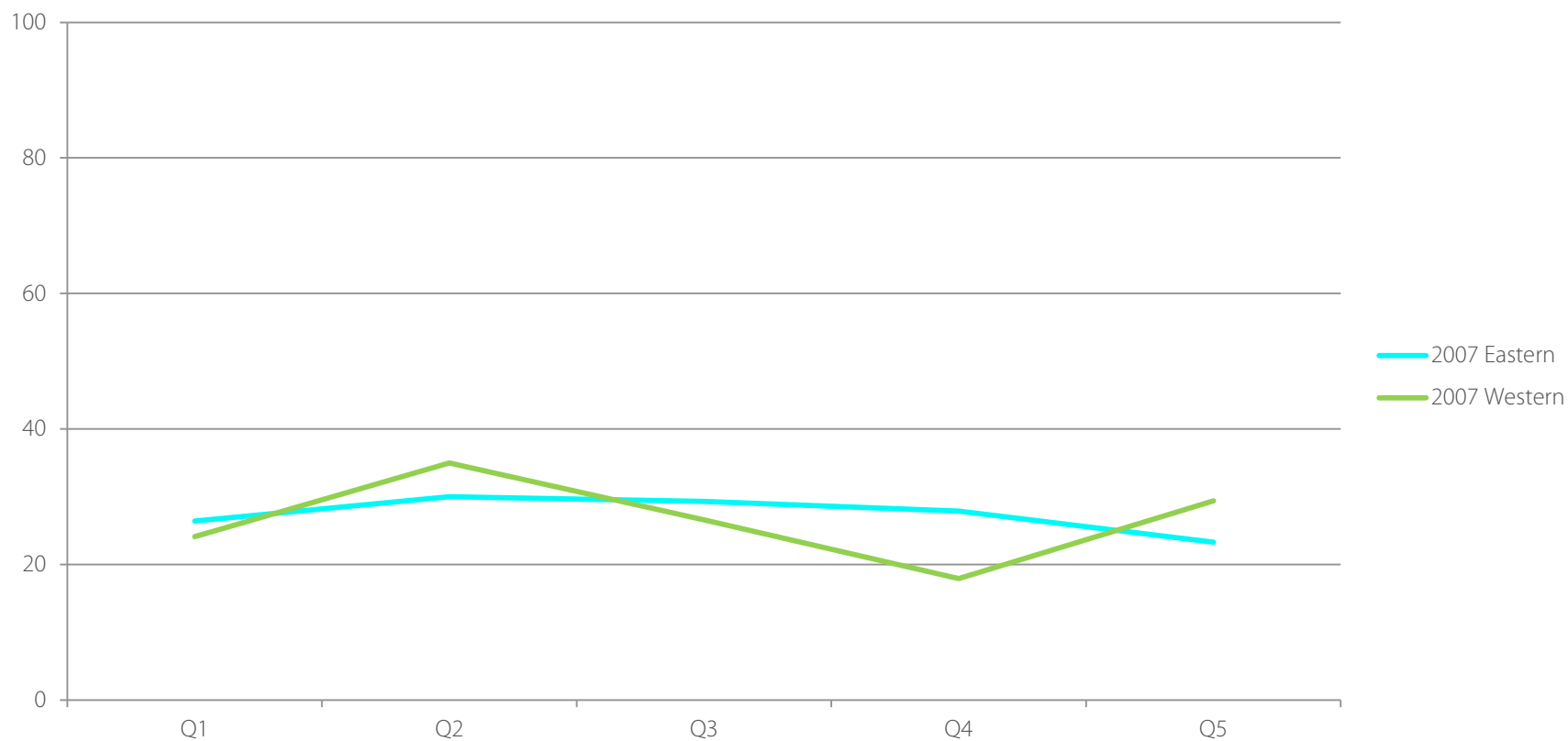
# Trends Western Region

	<b>2004</b>	<b>2007</b>	<b>2010</b>	<b>Trend</b>
	% [95% CI]	% [95% CI]	% [95% CI]	p-value
Positive Blood Slide	3.1 [1.6,5.7]	0.7 [0.2,2.3]	0.4 [0.2,0.8]	<0.01
Positive PCR		2.2 [1.2,4.1]	1.7 [1.2,2.6]	0.59
Household ownership of nets	95.9 [89.5,98.5]	96.6 [92.9,98.4]	99.4 [98.2,99.8]	0.03
Household ownership of ITNs	43.5 [31.0,56.9]	46.9 [35.1,58.9]	70.2 [57.9,80.2]	<0.01
Household ownership of LLINs		26.4 [18.3,36.6]	55.4 [41.9,68.1]	0.01
Sufficient ITNs	11.8 [7.6,18.0]	20.4 [13.7,29.3]	37.8 [28.9,47.5]	<0.01
Sufficient LLINs		8.7 [4.7,15.5]	25.7 [18.1,35.0]	<0.01
Slept under any net last night	77.2 [69.2,83.7]	78.1 [72.0,83.1]	82.3 [79.9,84.5]	0.2
Slept under ITN	33.3 [23.1,45.4]	33.6 [23.9,45.0]	45.9 [36.7,55.4]	0.1
Slept under LLIN		15.0 [10.3,21.3]	30.7 [22.8,39.9]	<0.01

# Trends Central Region

	<b>2004</b>	<b>2007</b>	<b>2010</b>	<b>Trend</b>
	% [95% CI]	% [95% CI]	% [95% CI]	p-value
Positive Blood Slide	0.2 [0.1,1.2]		0.5 [0.2,1.1]	0.39
Household ownership of nets	98.0 [96.6,98.8]		99.5 [98.7,99.8]	0.015
Household ownership of ITNs	9.7 [5.4,16.8]		65.1 [47.1,79.7]	<0.01
Household ownership of LLINs			59.4 [42.3,74.5]	
Sufficient ITNs	1.8 [1.0,3.4]		31.0 [21.7,42.3]	<0.01
Sufficient LLINs			24.5 [16.3,35.2]	
Slept under any net last night	80.4 [76.1,84.1]		83.6 [79.7,86.8]	0.26
Slept under ITN	5.6 [3.1,10.0]		46.0 [33.6,59.1]	<0.01
Slept under LLIN			38.0 [27.1,50.4]	

# Ownership of LLINs by wealth index



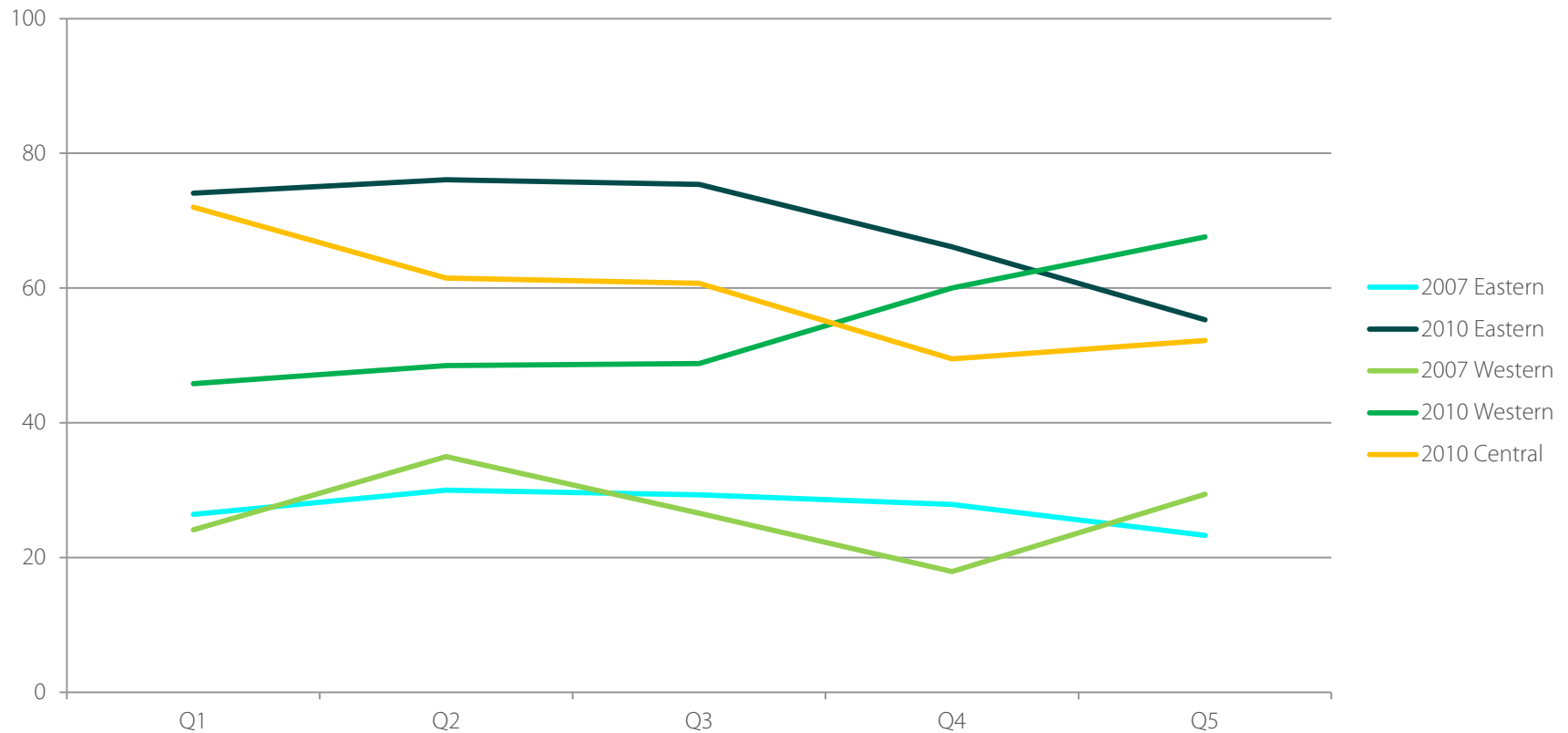
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# Ownership of LLINs by wealth index



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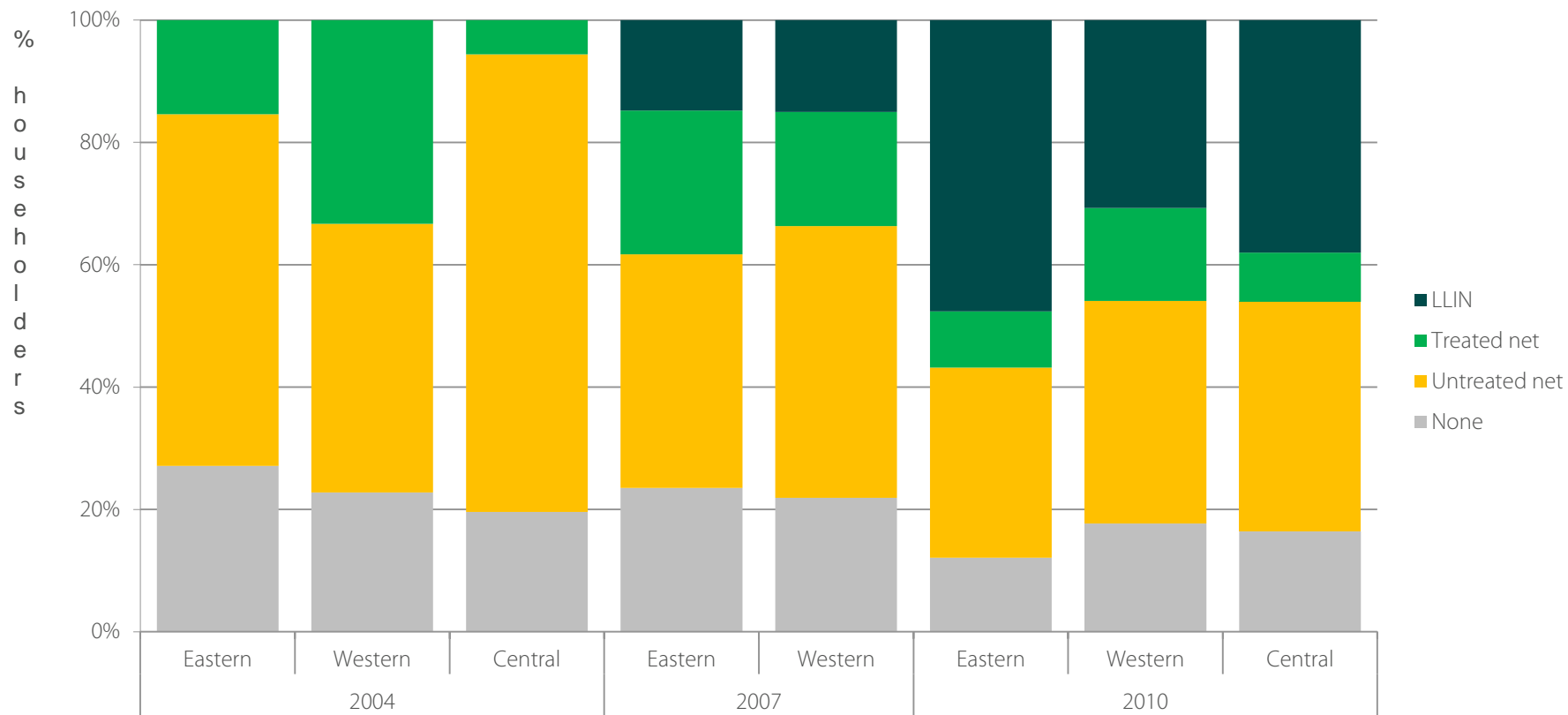
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# Net use



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# Key findings

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## Prevalence:

Linear trends *by region* were considered to be adequate  
A **3-fold decrease** in prev every 3 yrs in the **W region**  
compared to a **less than 2-fold decrease** in the **E region** and  
these trends were statistically significant  
**Declines in PCR less marked** and only significant in E region

## Preliminary findings CMS2013:

14 positive slides (3 PF and 8 PV) ~0.2%

Unweighted prevalences: Eastern ~0.3%

Western ~0.2%

Central ~0.1%

# Key findings

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## Mosquito net:

### Coverage

In 2004, HH ownership of ITNs was highest in the W region, followed by E and then C (43.5%, 22.3% and 9.7%). By 2010 the % increased to 70.2%, 77.8% and 65.1% respectively

**HH ownership of LLIN's had increased from 1 in 4 HHs owning one in 2007 to 3 in 4 HHs in 2010**

# Key findings

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## Mosquito net:

### Use

In 2004, the % of HHs sleeping under an ITN 33.3, 15.4% and 5.6% in the W, E and C provinces

***By 2010, it increased to almost 50% across all regions***

Sleeping under LLIN's were approximately 15% in the Eastern and Western provinces in 2007 and this increased to 48% in the Eastern provinces and 31% in the Western province

# Moving forward

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Malaria Consortium will continue its support to NMCPs in conducting M&E activities in the region paying especial attention to:

- **Identification of hot spots** and clusters
- **Identification of alternative M&E tools** (e.g. harder and harder to detect statistically significant differences as transmission lowers and prevalence reach <1% - usefulness of large scale surveys based on prevalence?)
- **Supporting re-stratification of malaria** and suggesting optimal approaches that could enable comparability of future trend analyses



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