Malaria predicts maternal and child anemia in Uganda and is modulated by altitude and prior IRS.

Initial analysis of data from the Nutrition Innovation Laboratory 2012 6-District Survey *with some updated data from 2014* and a Framework for connecting Agriculture, Nutrition, and Health

Background & Rationale

- **Anemia** is the leading cause of death in pregnant women, and leads to much morbidity. It is a leading **nutrition indicator**. It is often due to a nutritional lack of **iron** and **vitamins.**
- **Blood hemoglobin** is measured, and allows categorization into “anemic” or “not anemic.”
- **Hookworm** and **malaria** lead to anemia. To **understand agricultural/dietary influences** on anemia, we should **control for these infections**.
- **In surveys we assessed hemoglobin and malaria – Oct->Dec 2012; Oct->Dec 2014.**

Sequential Panel Data – 6 Districts (4 North, 2 South)

- 3,600 households in first survey Oct-Dec 2012
- In second survey, returned to same households to examine changes in agricultural practices, nutrition, health which may be related to Uganda Community Connector.
- Obtained hemoglobin and RDT-based malaria prevalence (not self-reported prevalence).
- Interested in Agriculture-Nutrition linkages
- 3,330 households assessed in 2014 survey

Malaria Prevalence and Hemoglobins in Children 0-24 Months.

- In 2,008 index children aged 0 to 24 months, malaria prevalence increased from < 3% to 50% with age in 2012. Overall mean Hgb values differed significantly in young children with (n=483) and without (n=1450) malaria **(9.94 ± 1.57 versus 11.20 ± 1.56 g/dL, p< 0.001**) as well as by month of age.
- ***Update 2014:*** *similar difference in Hgbs in this age range.* ***9.85*** *vs.* ***11.31****, n=216 vs 1,013.*

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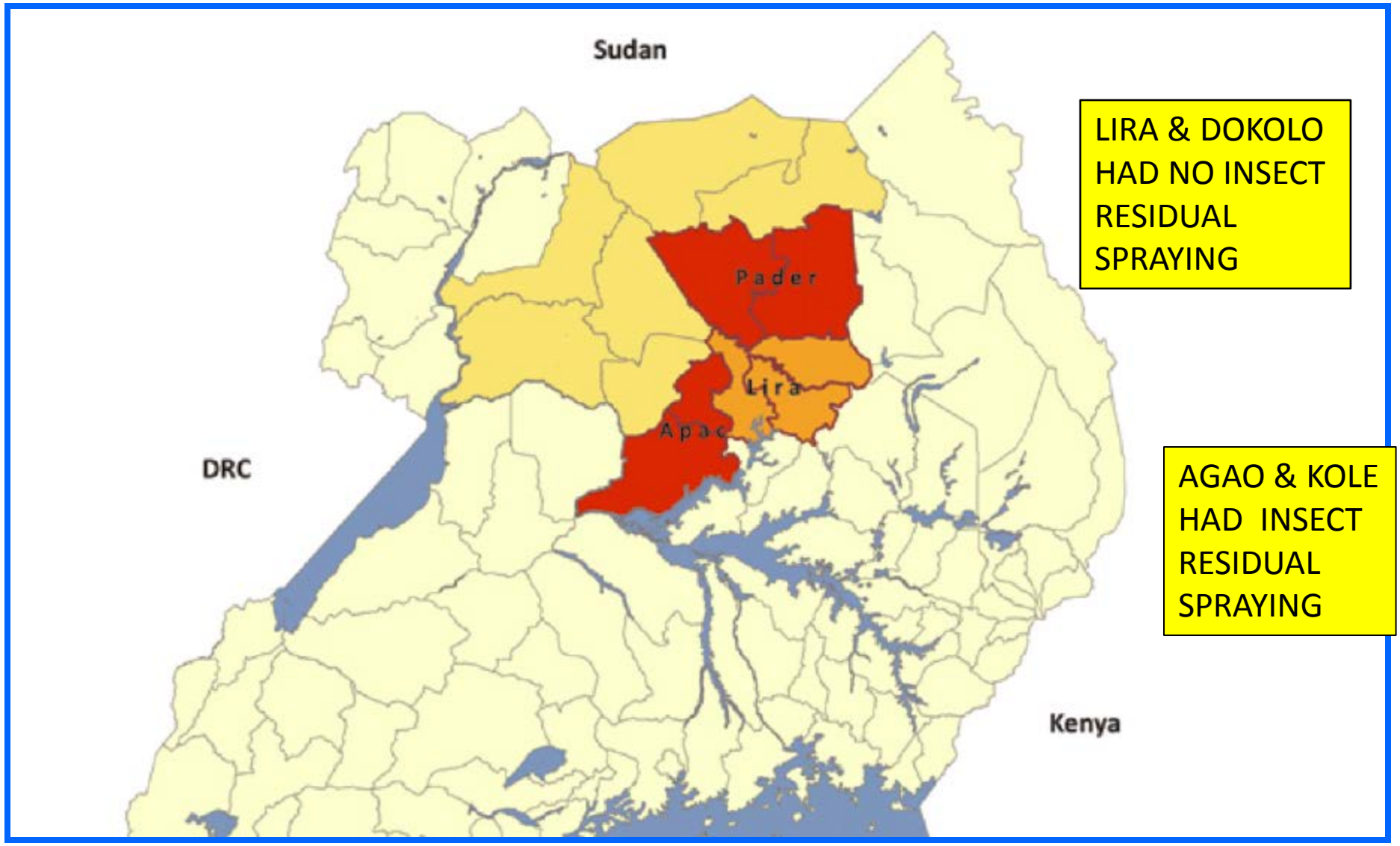

Effect of IRS on Malaria and Anemia ….Am. J. Trop. Med. Hyg., 88(5), 2013, pp. 855–861

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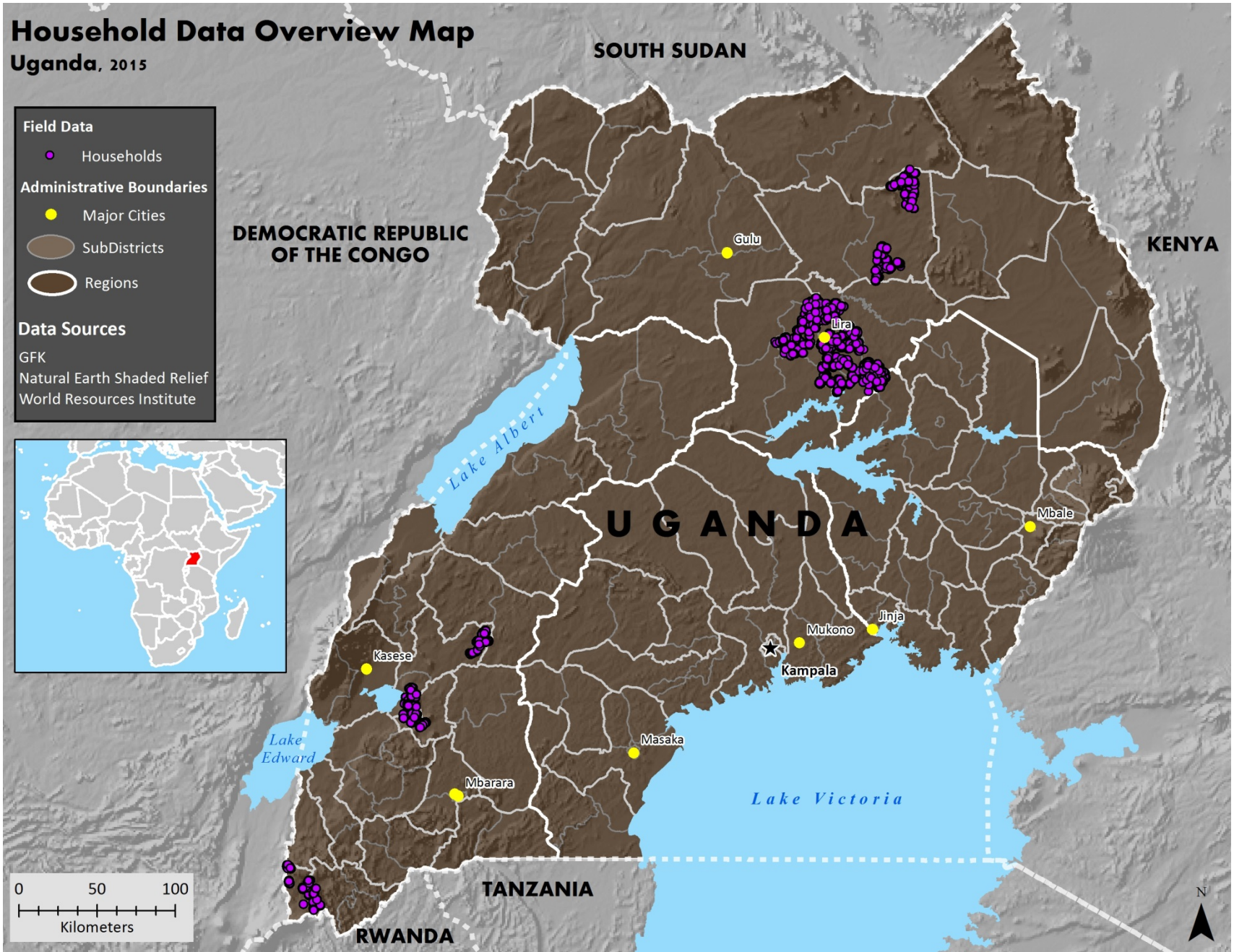
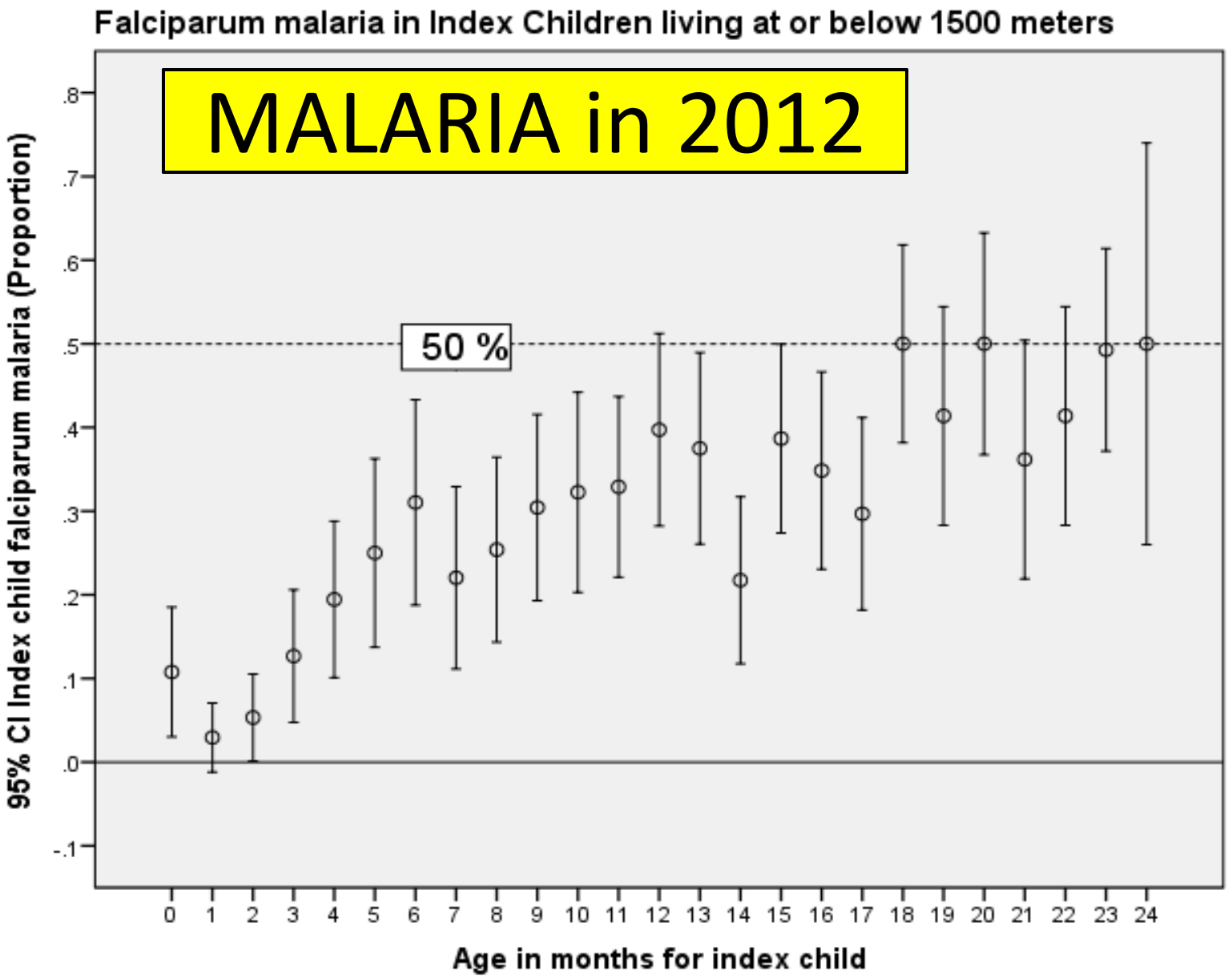
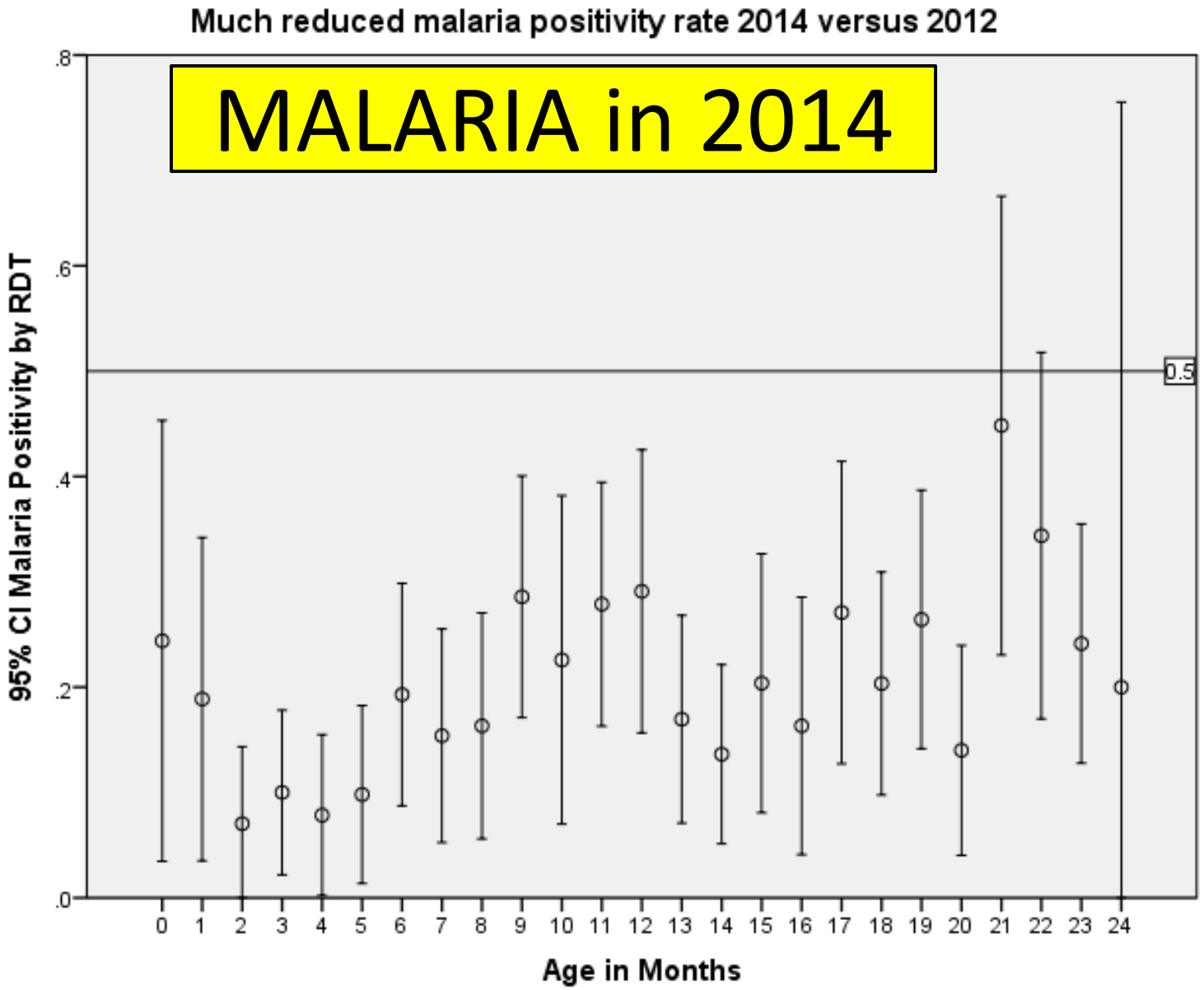



Falciparum malaria in Index Children living at or below 1500 meters
MALARIA in 2012
95% CI Index child falciparum malaria (Proportion)
.8
.7
.6
.5
.4
.3
.2
.1
.0
-.1
50 %
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Age in months for index child


Much reduced malaria positivity rate 2014 versus 2012
MALARIA in 2014
95% CI Malaria Positivity by RDT
.8
.6
.4
.2
.0
0.5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Age in Months

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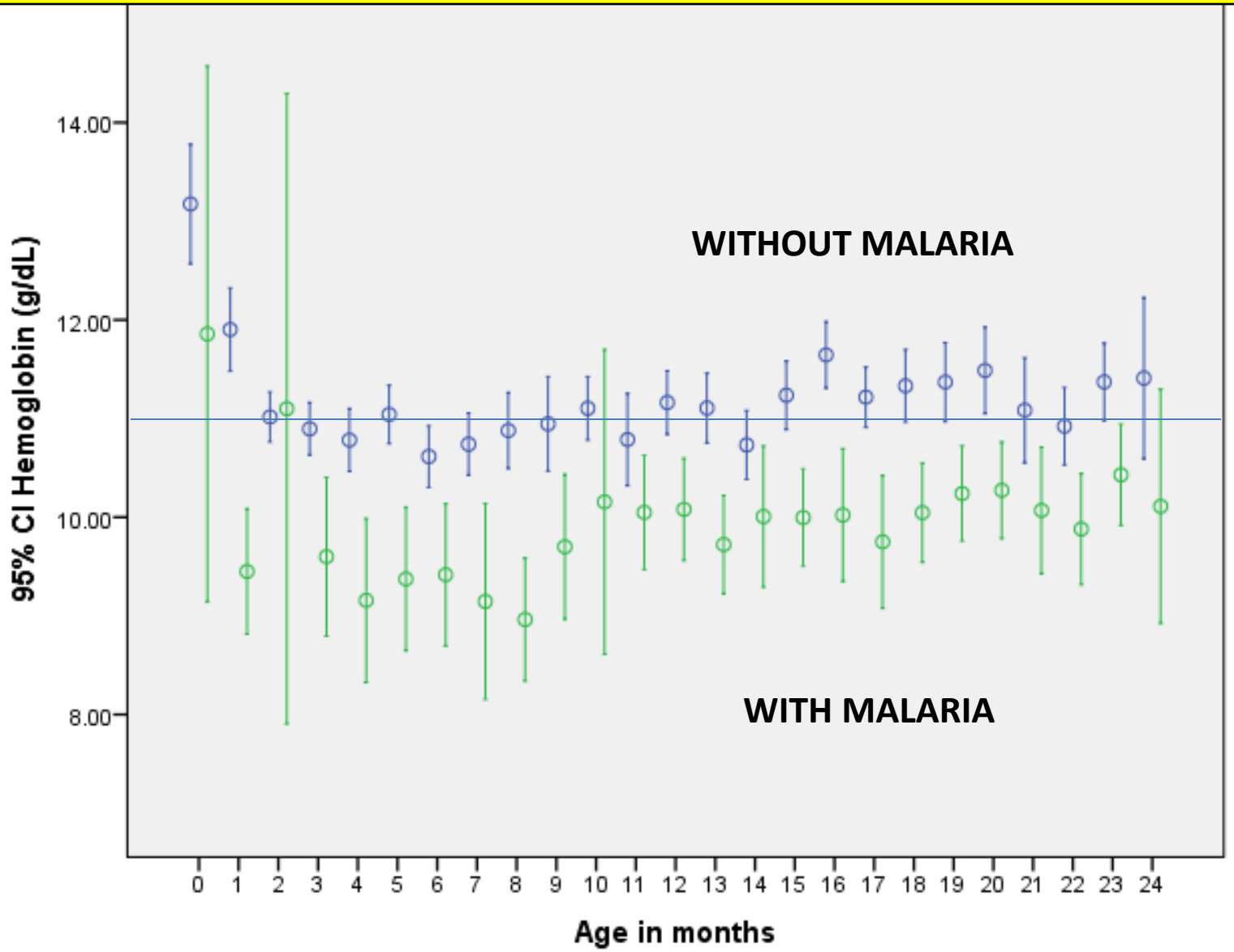
Hgbs in children with and out malaria **by age 2012**



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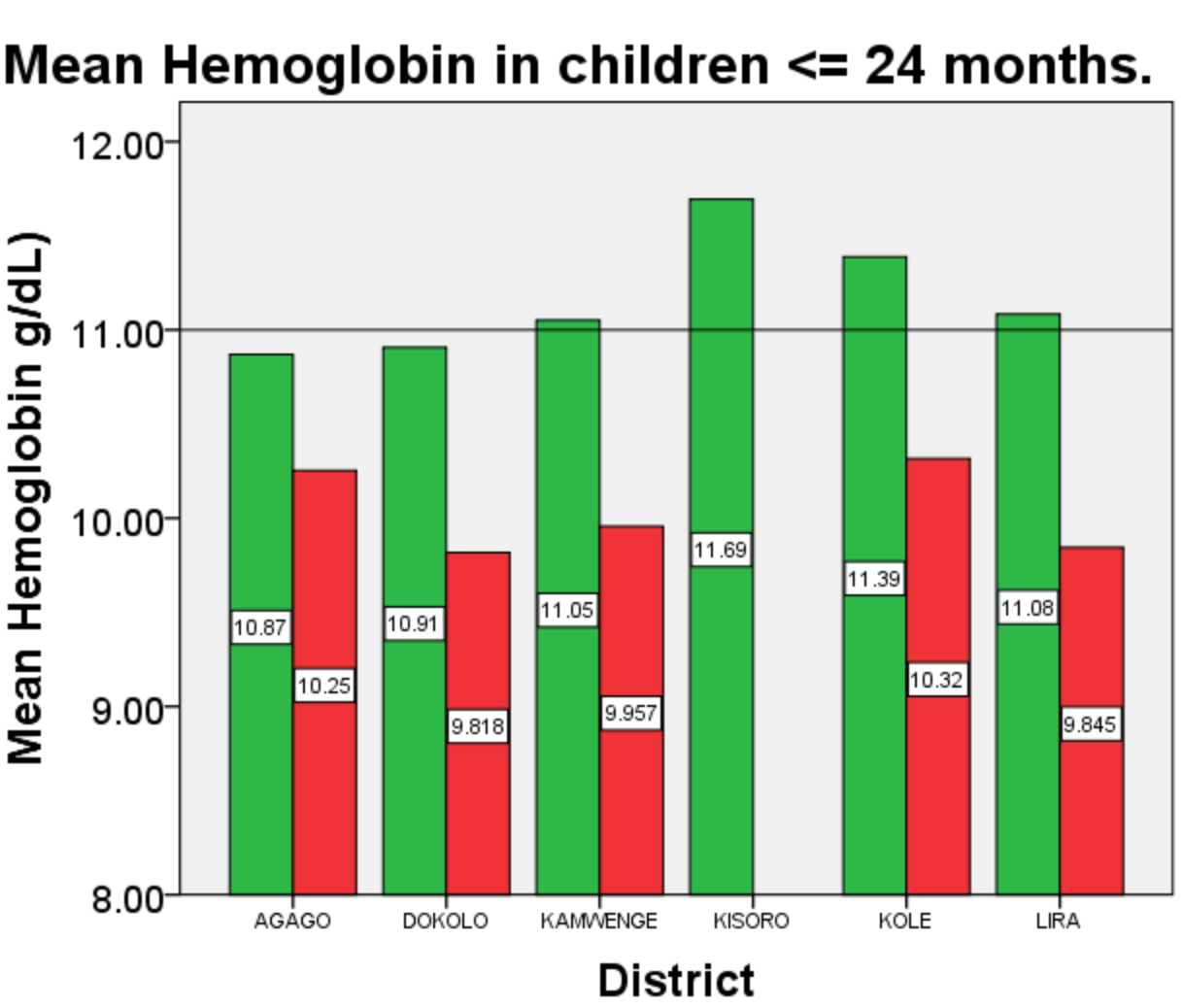


DISTRICT SPECIFIC DATA

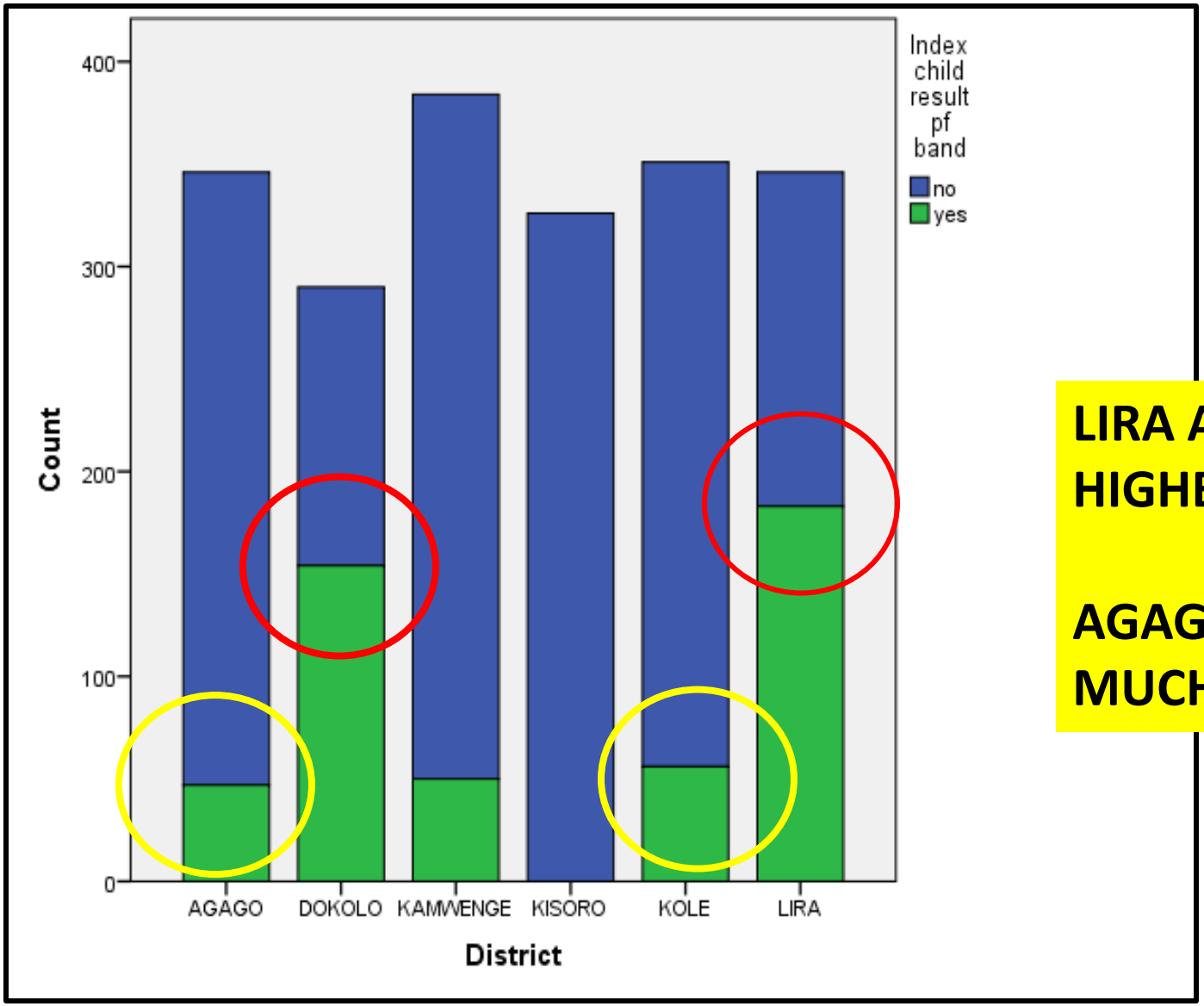
Green – no falciparum malaria

Red – with f. malaria

*Kisoro – no index children had malaria

*All differences between children with and without malaria in a given district are significant

Crude malaria rate in children 0-24 m



LIRA AND DOKOLO HIGHEST RATES

AGAGO AND KOLE MUCH LOWER

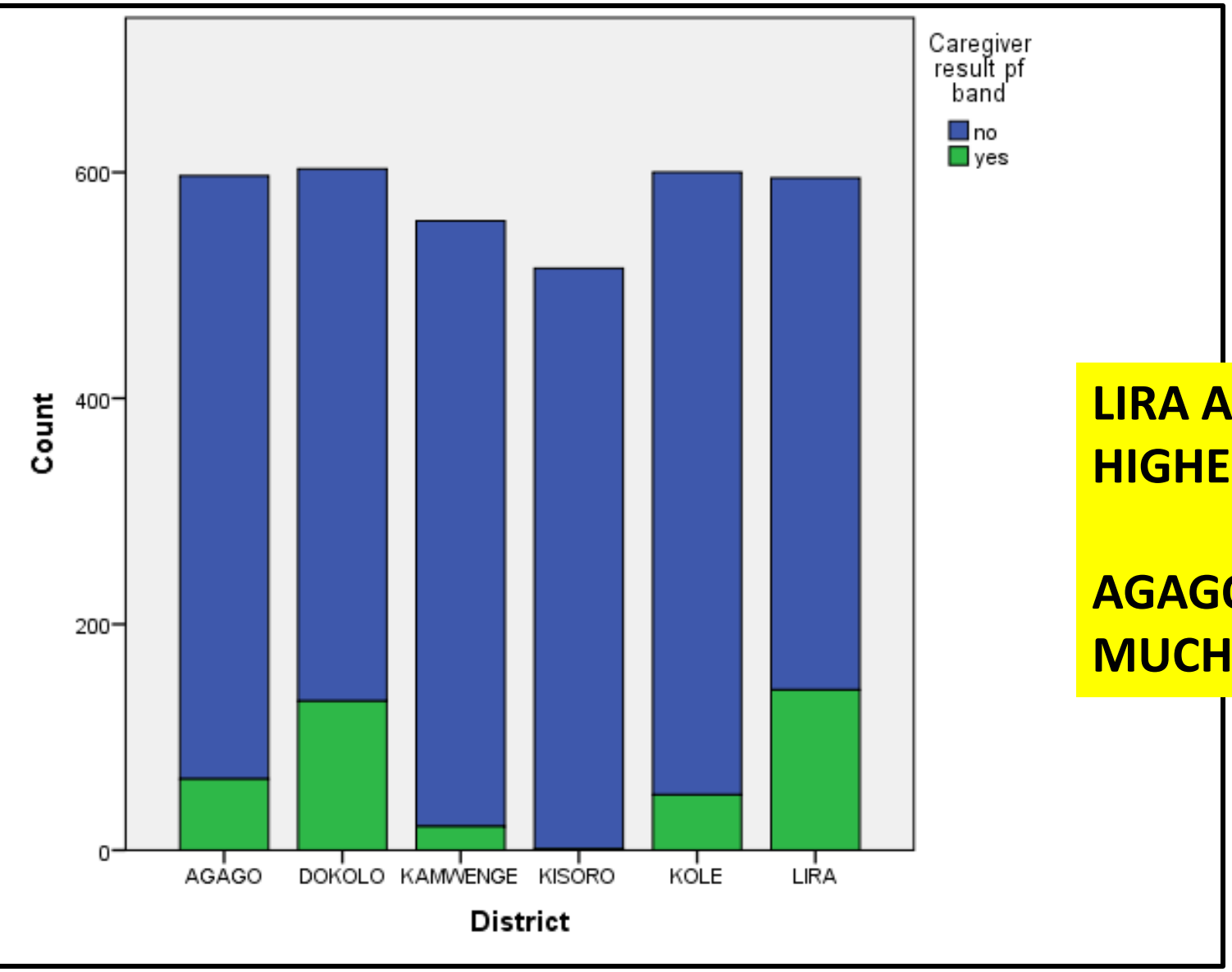
2012 vs. 2014

Children under 24 months	Pos	Neg	Percent Positive
Dokolo 2012 no IRS	158	132	290 (54.5%)
Dokolo 2014 no IRS	92	116	208 (44.2%)
p=0.0291			
Lira 2012 no IRS	185	162	347 (53.3%)
Lira 2014 no IRS	74	97	171 (43.3%)
p=0.0397			
Kole 2012 sprayed	58	294	362 (16.0%)
Kole 2014	35	192	227 (15.4%)
p=0.8168, NS			
Agago 2012 sprayed	50	266	316 (15.8%)
Agago 2014	20	254	274 (7.3%)
p=0.0014			

2012 vs. 2014

Children <= 24 months			
Kamwenge 2012	51	338	381 (13.4%)
Kamwenge 2014	10	166	176 (5.7%)
P=0.0081			
Kisoro 2012	0	323	323
Kisoro 2014	0	239	239
NS (no malaria)			

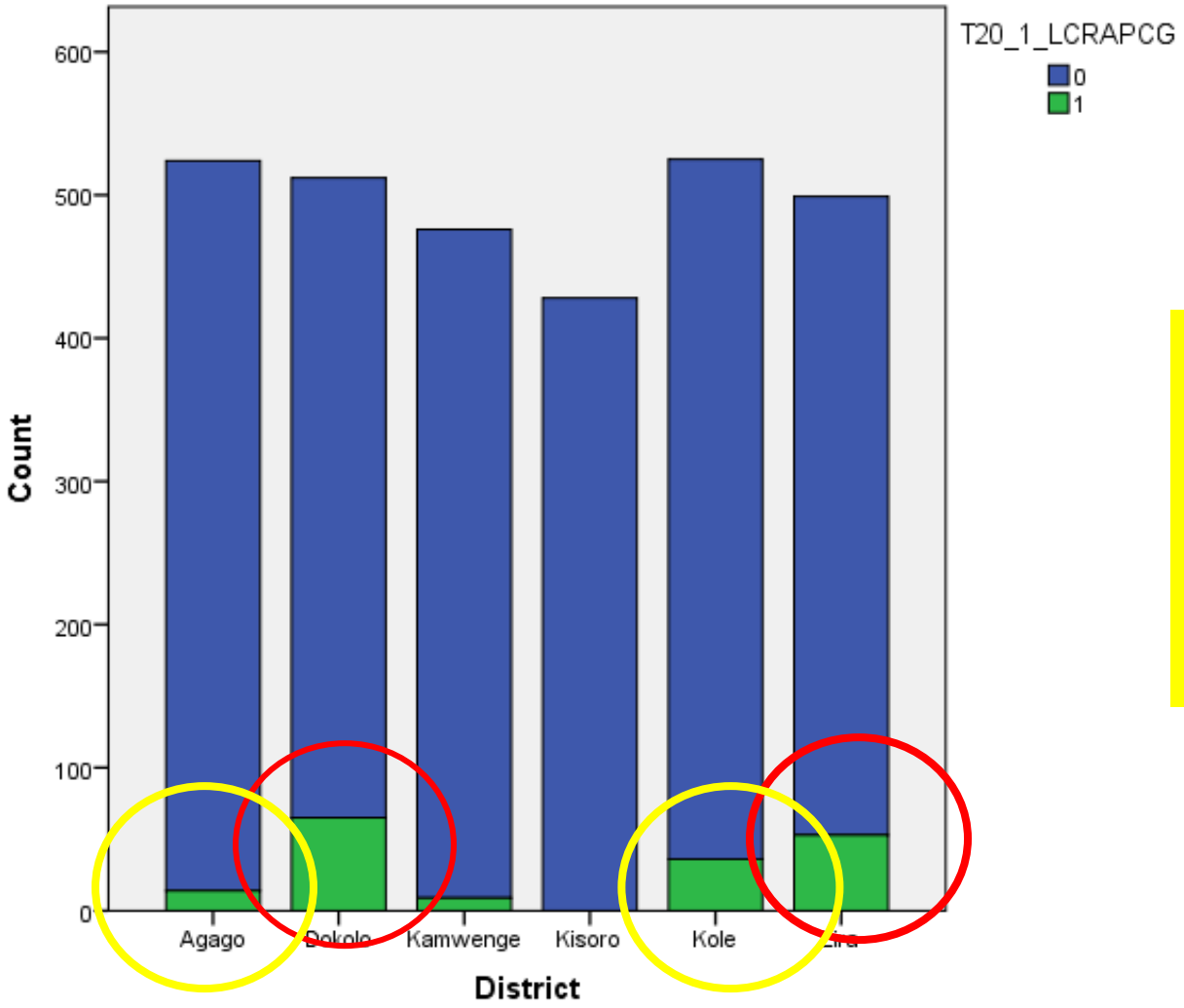
Crude malaria rate - caregiving women 2012



LIRA AND DOKOLO HIGHEST RATES

AGAGO AND KOLE MUCH LOWER

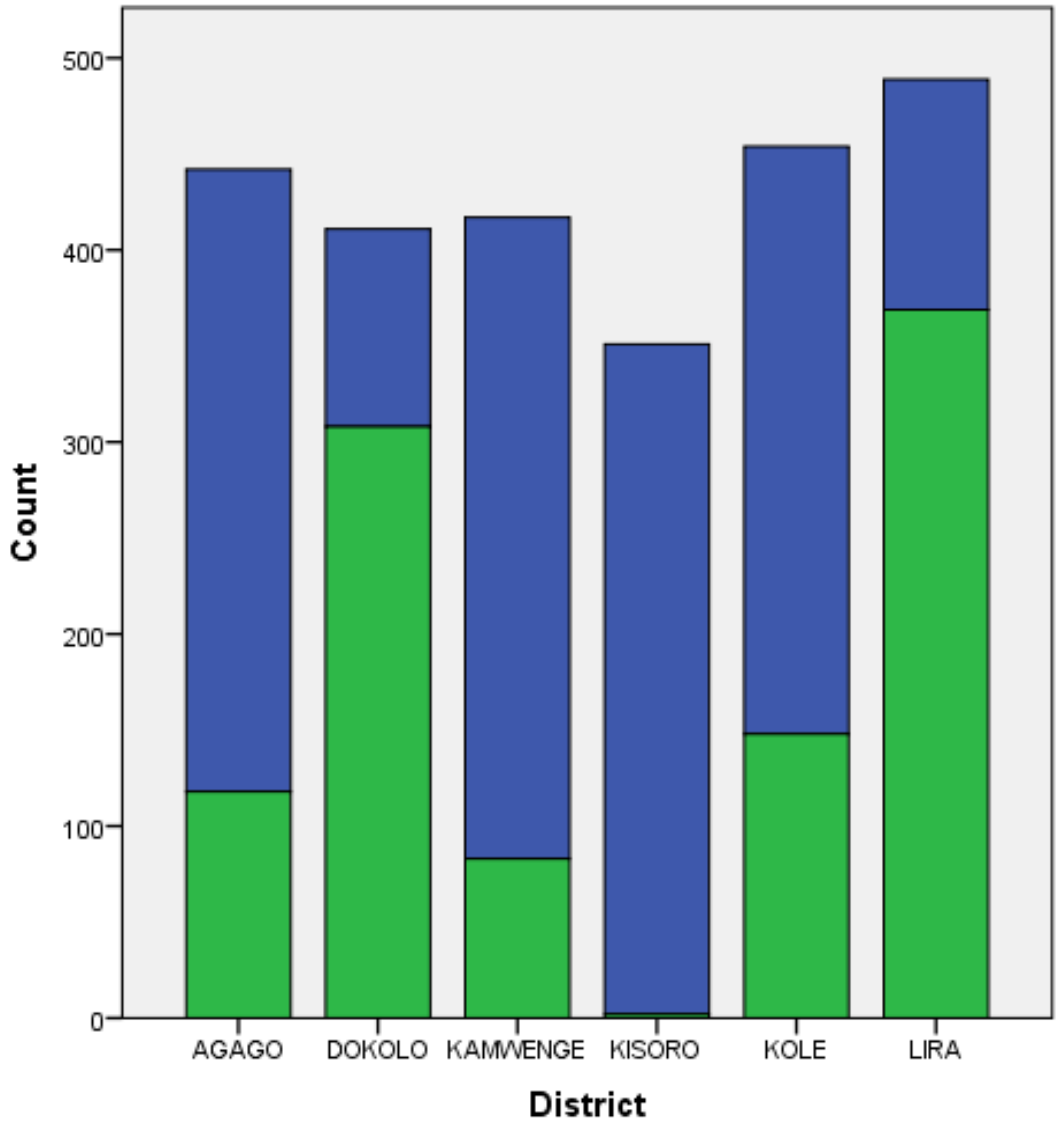
Maternal ("female caregiver)malaria



LIRA AND DOKOLO HIGHEST RATES

AGAGO AND KOLE MUCH LOWER

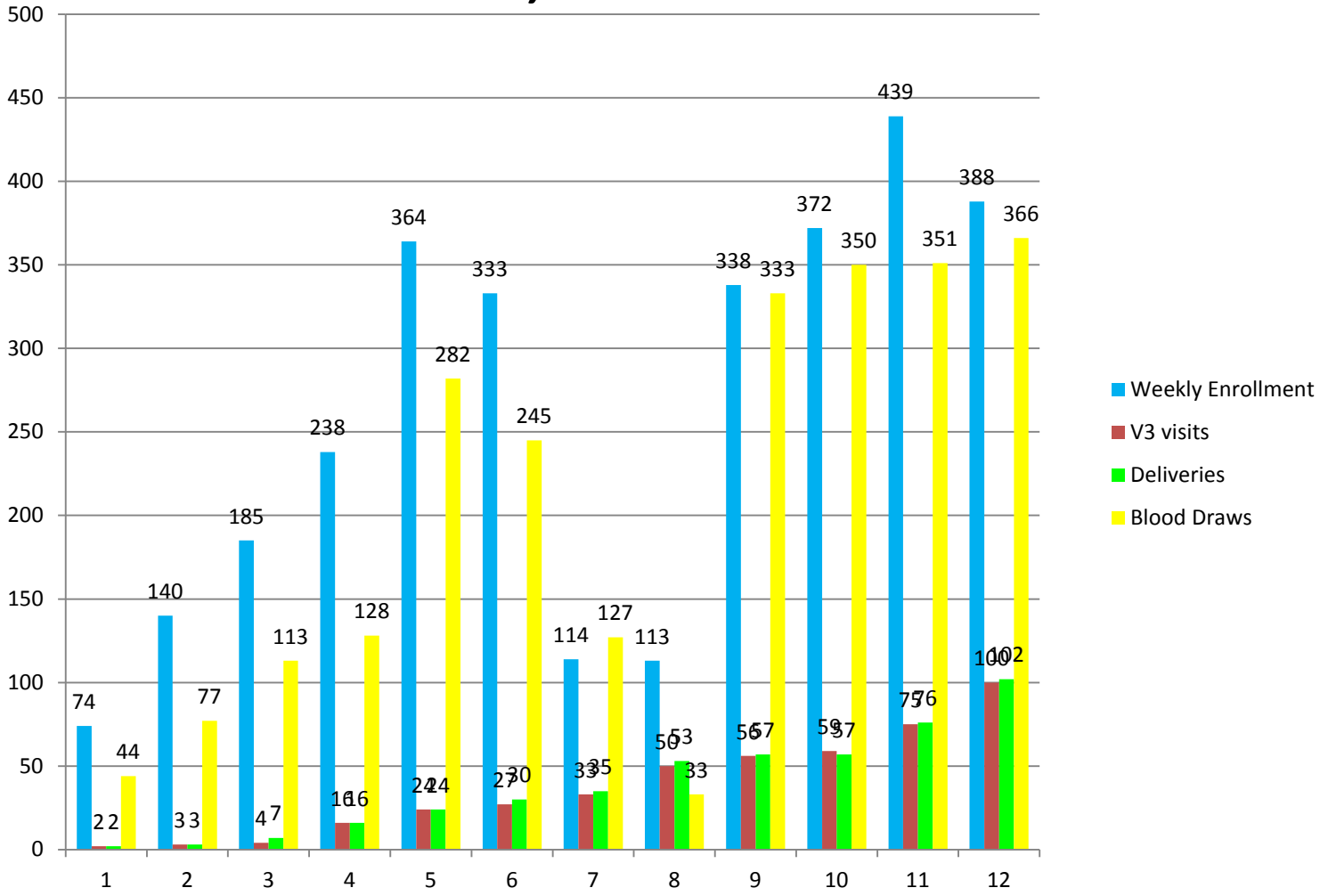
Crude malaria rate in children 24-60 m



This data is for 2012; 2014 data still being Assembled

LIRA AND DOKOLO HIGHEST RATES
NO IRS

12 District (16 subcounty) birth cohort > 3100 out of 5,000 women enrolled



Birth cohort study areas

South		**NORTH**	
Kabale	Ruhija	Nebbi	Parombo
Kabale	Nyamweru	Zombo	Atyak
Kanungu	Rugyeyo	Pader	Atanga
Kabarole	Kibiito	Lamwo	Agoro
Kamwenge	Bwizi	Lira	Agweng
Rukungiri	Kebisoni	Kole	Ayer
Rukungiri	Buyanja	Apac	Aduku
Rukungiri	Bugangari	Apac	Apac