

Malaria control in schools: health and educational benefits

Simon Brooker

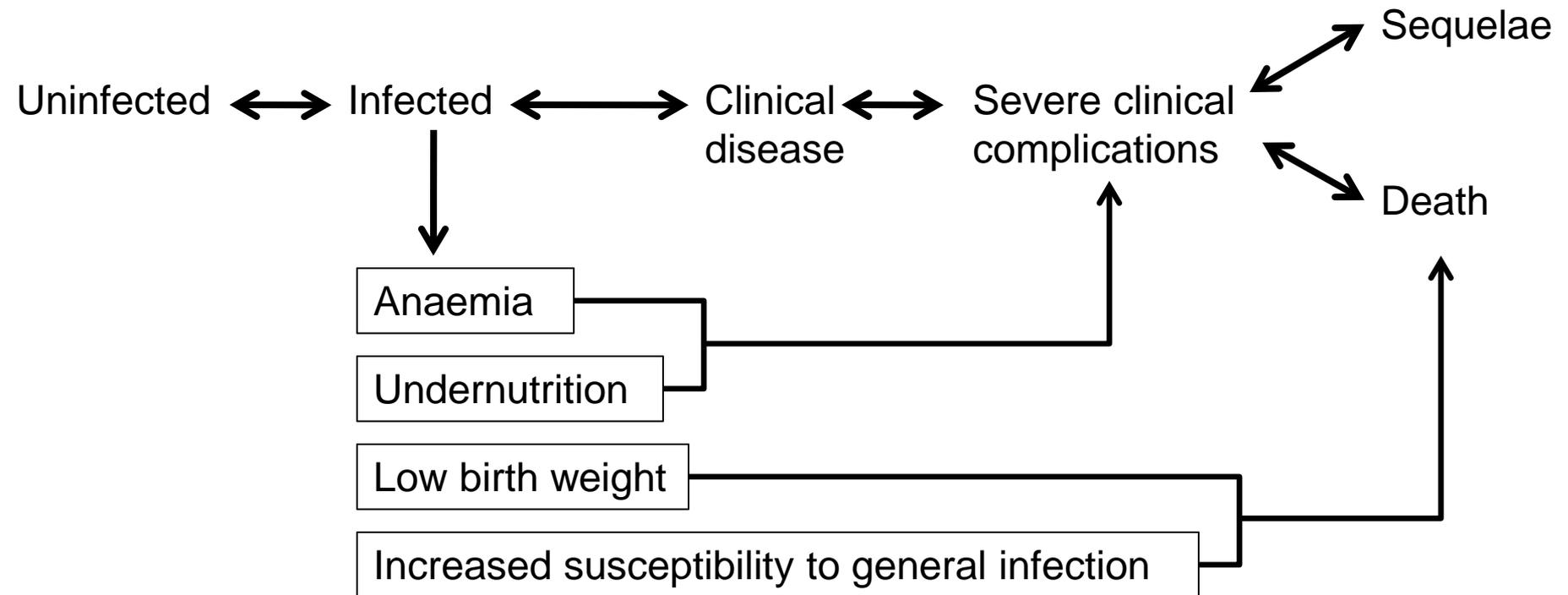
London School of Hygiene and Tropical Medicine

Kenya Medical Research Institute-Wellcome Trust Research Programme, Nairobi

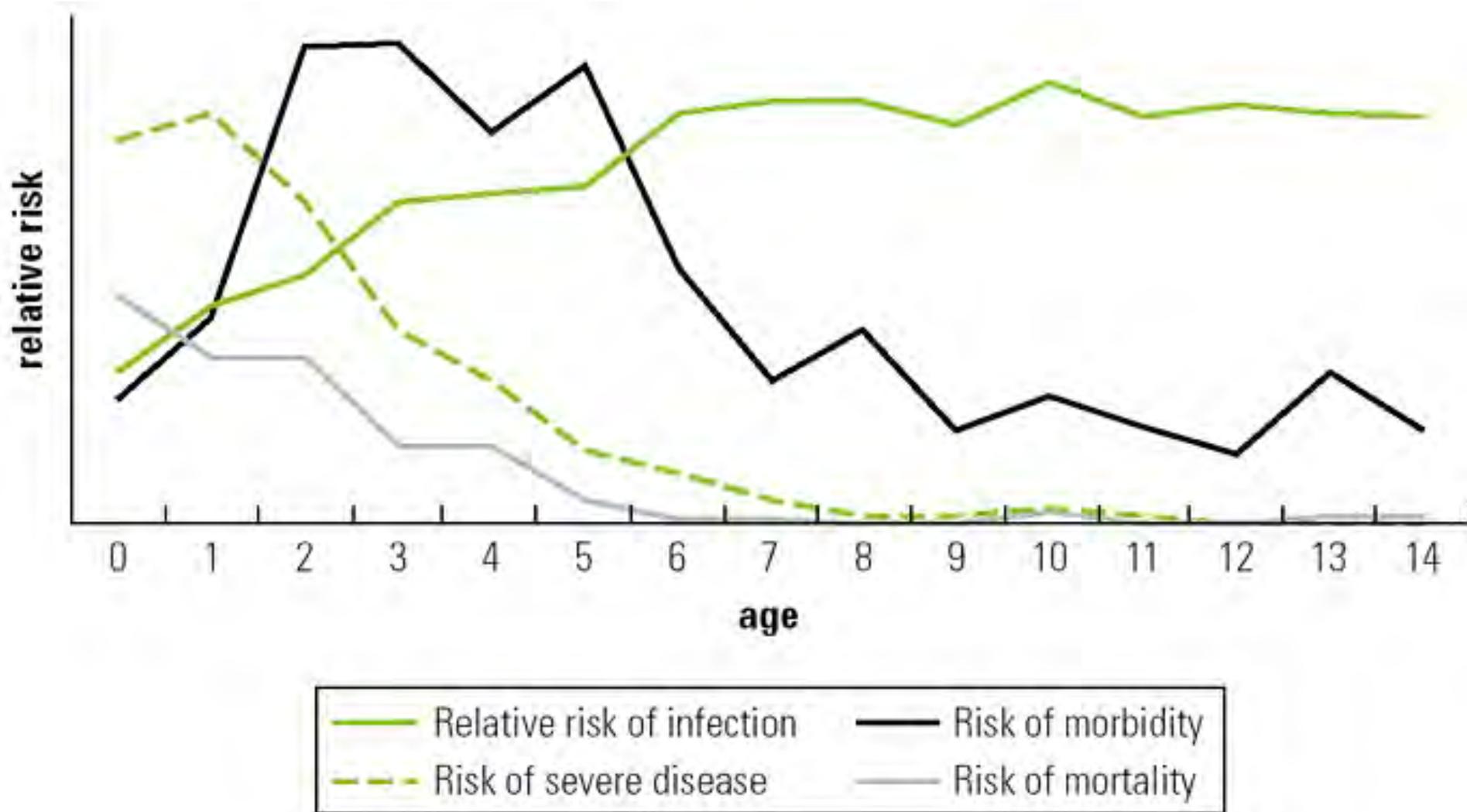
Save the Children webinar

June 15th 2012

Consequences of malaria



Malaria infection and disease by age



Malaria control strategies

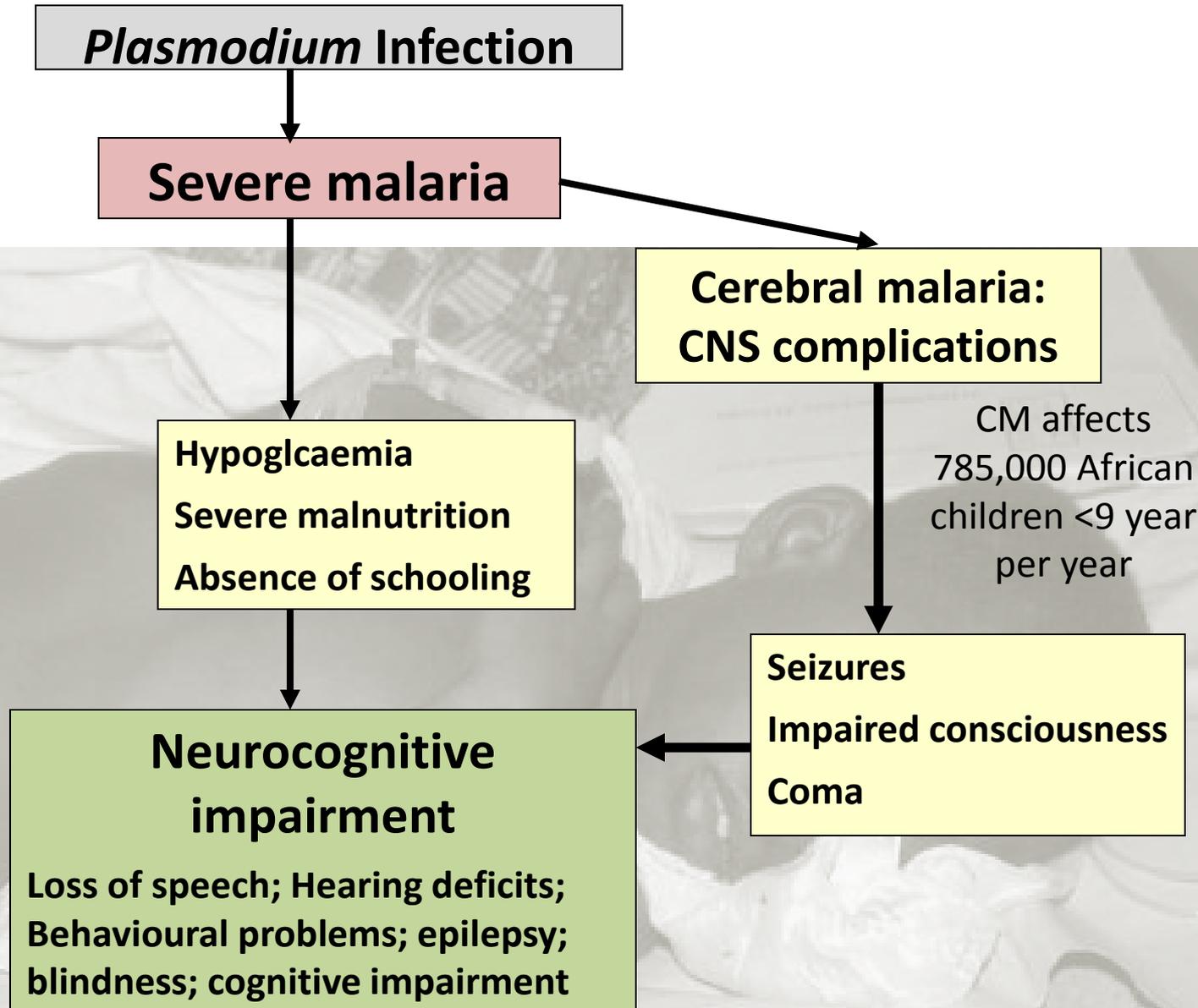
Prompt access to treatment with effective antimalarials, such as Artemisinin-based Combination Therapies (ACTs)

Use of insecticide treated nets

Indoor residual spraying

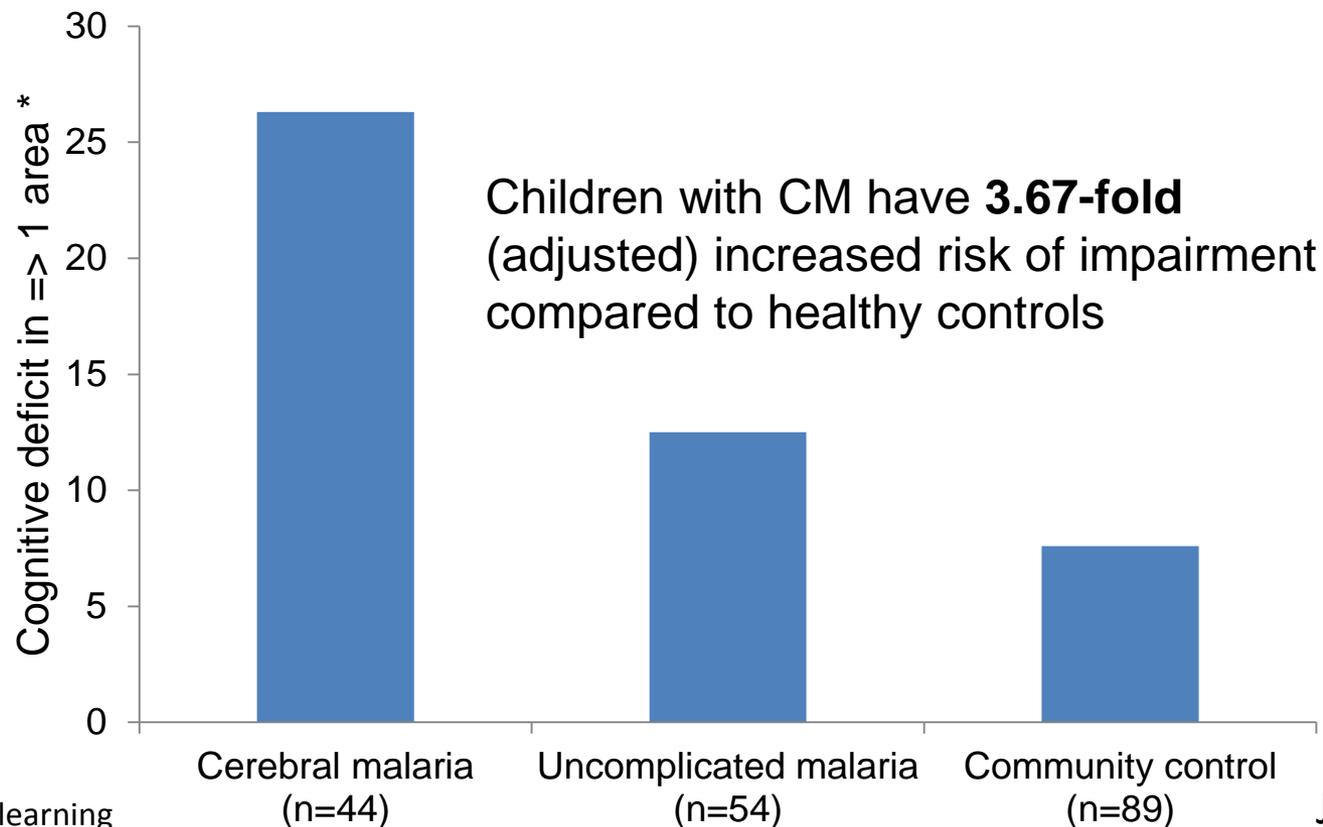
Preventive treatment in pregnancy and childhood

Causal pathway of malaria's impact on neurocognitive impairment

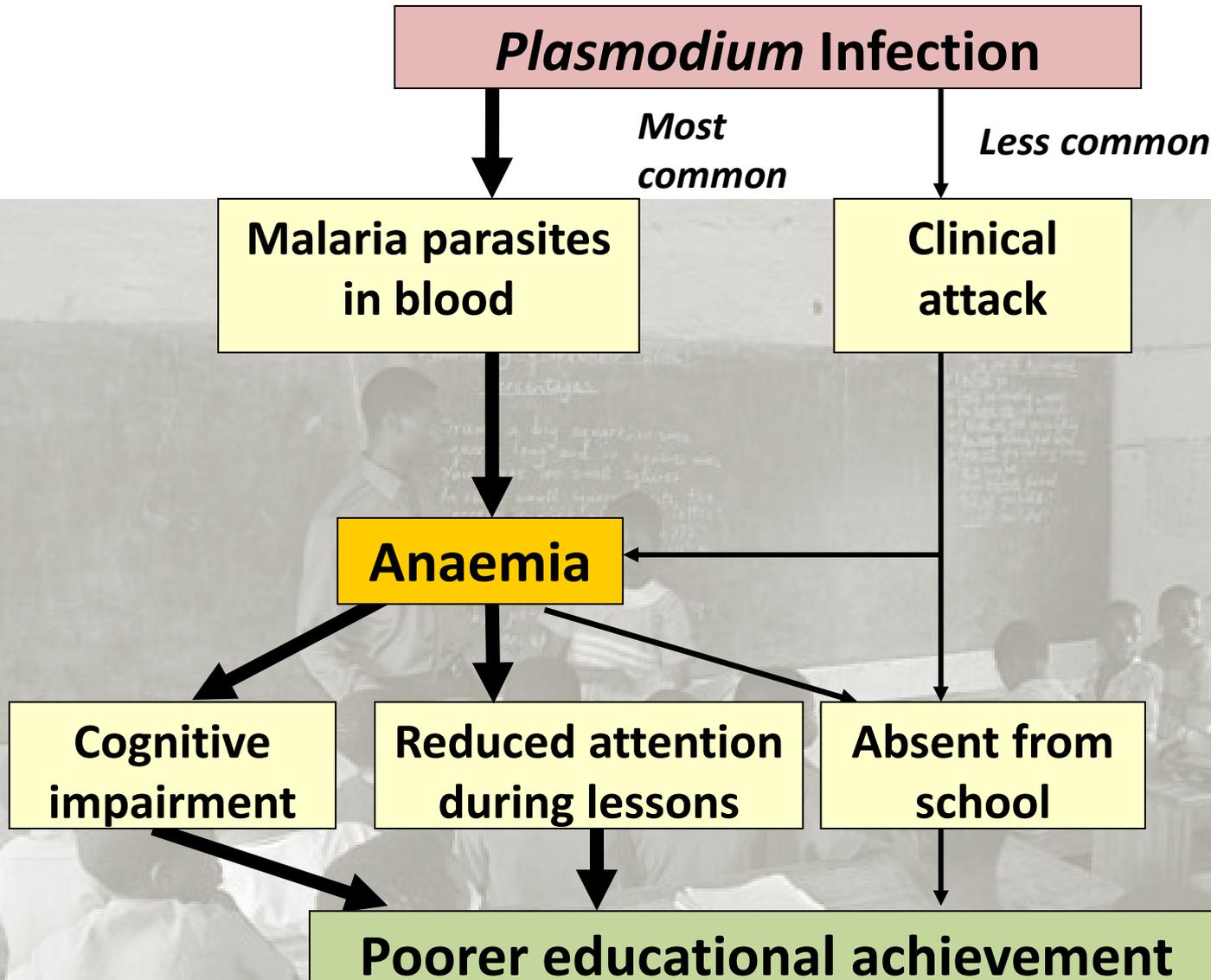


Long-term cognitive impacts of cerebral malaria among school-aged children in Uganda: case-control study

- 5-12 yr olds who presented to Mulago Hospital with cerebral malaria or uncomplicated malaria matched to health controls
- Cognitive testing at enrollment and 2 years follow-up



Causal pathway of malaria's impact on education

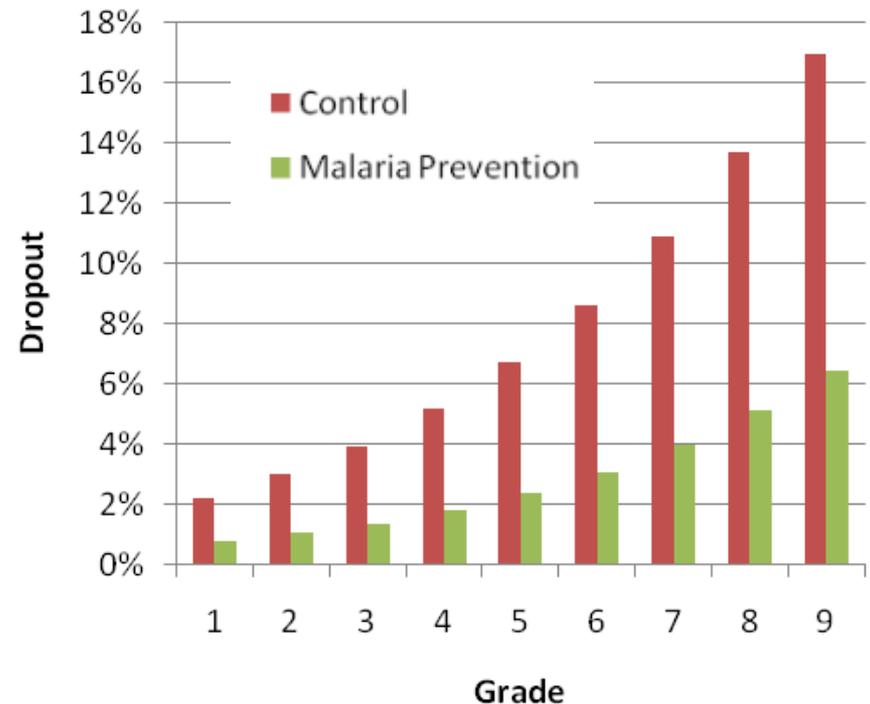
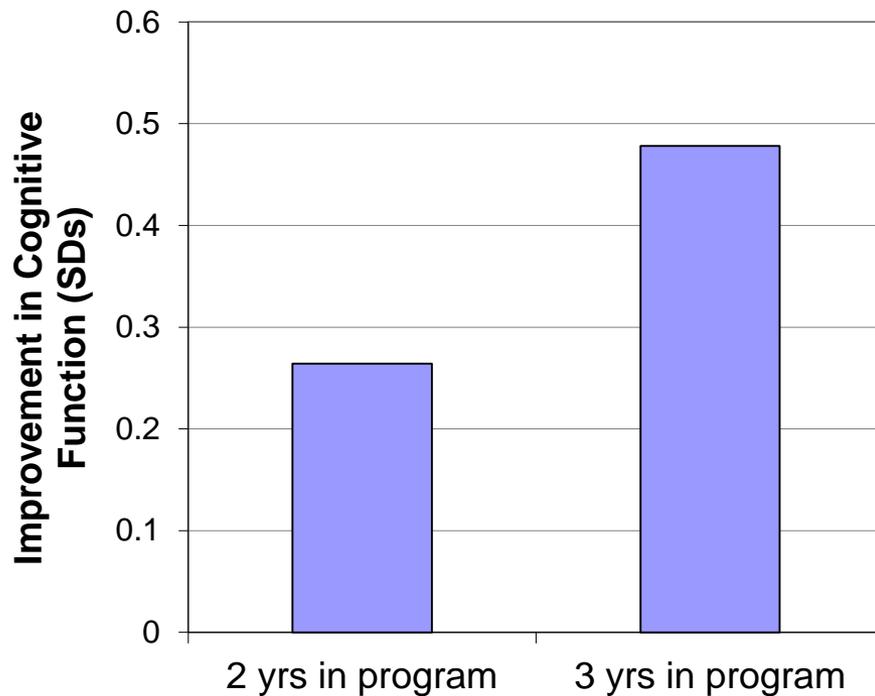


Impact of early childhood malaria chemoprophylaxis on educational attainment in The Gambia: long-term follow-up of a randomised trial

- Malaria chemoprophylaxis trial, 1983-87
- Children aged 3-59 months in 10 villages
- Assigned alternatively by compound to receive placebo or Maloprim, a malaria chemoprophylaxis
- At the end of the trial, Maloprim offered to all children
- 73% reduction in attacks of clinical malaria
- Reduction in mortality
- Reduced prevalence of anaemia

Early chemoprophylaxis leads to improved cognitive performance and school enrolment

- Children were traced 14-16 years later (48% traced)
- Battery of cognitive and educational tests administered



Impact of clinical malaria in school children: evidence from Sri Lanka

- Cross-sectional study showing that cognitive performance at school entry was related to number of previous malaria attacks
- Performance in language and maths deteriorated among children experiencing malaria attack and improved 2 weeks following attack, but still lower than among healthy children
- Individual randomised trial showing that education attainment and school absenteeism improved among children taking chloroquine prophylaxis for nine months (n=295) compared to controls (n=292)

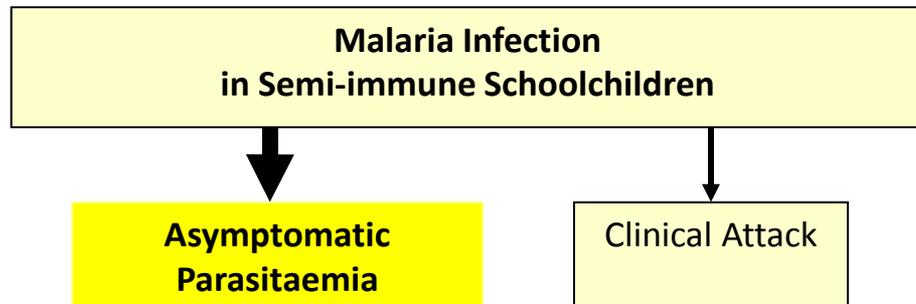
A cluster randomised trial of intermittent preventive treatment in western Kenya, 2006



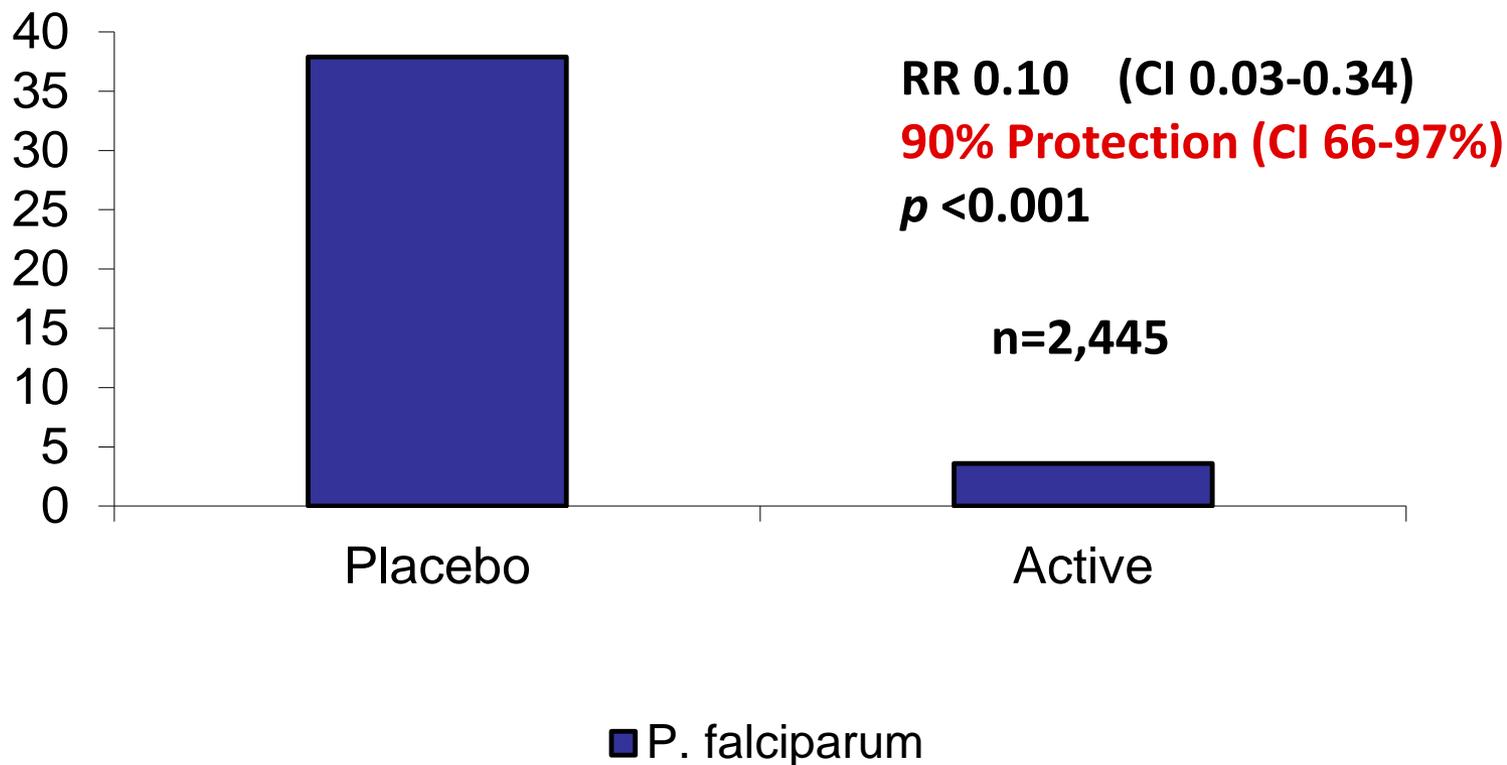
- 30 schools randomised according to educational strata
- Age range 4-16 yrs, cognitive/educational assessment in classes 5-6
- Sulfadoxine-pyrimethamine (SP) + amodiaquine (AQ) once a term
- Double placebo
- All schools received deworming with albendazole
- Baseline and 12 month follow-up health and education surveys



Impact of IPT on malaria parasitaemia



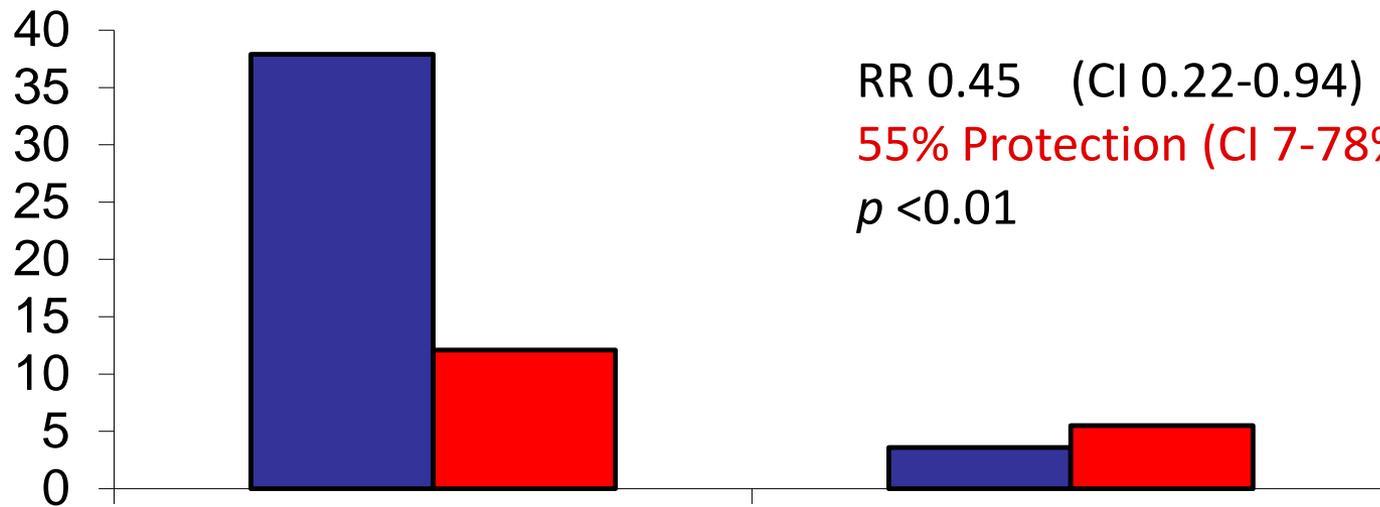
Prevalence (%)



Impact of IPT on haemoglobin level

n=2,462

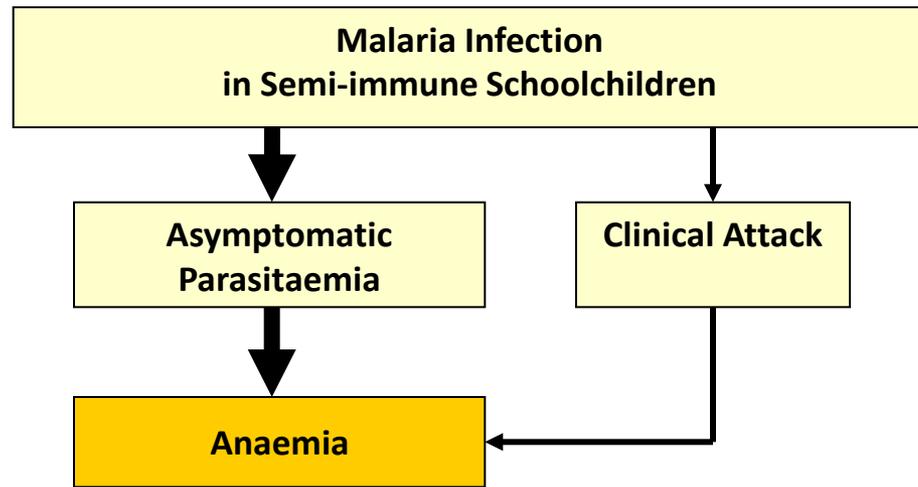
Prevalence (%)



Placebo

Active

■ *P. falciparum* ■ Anaemia <110g/L



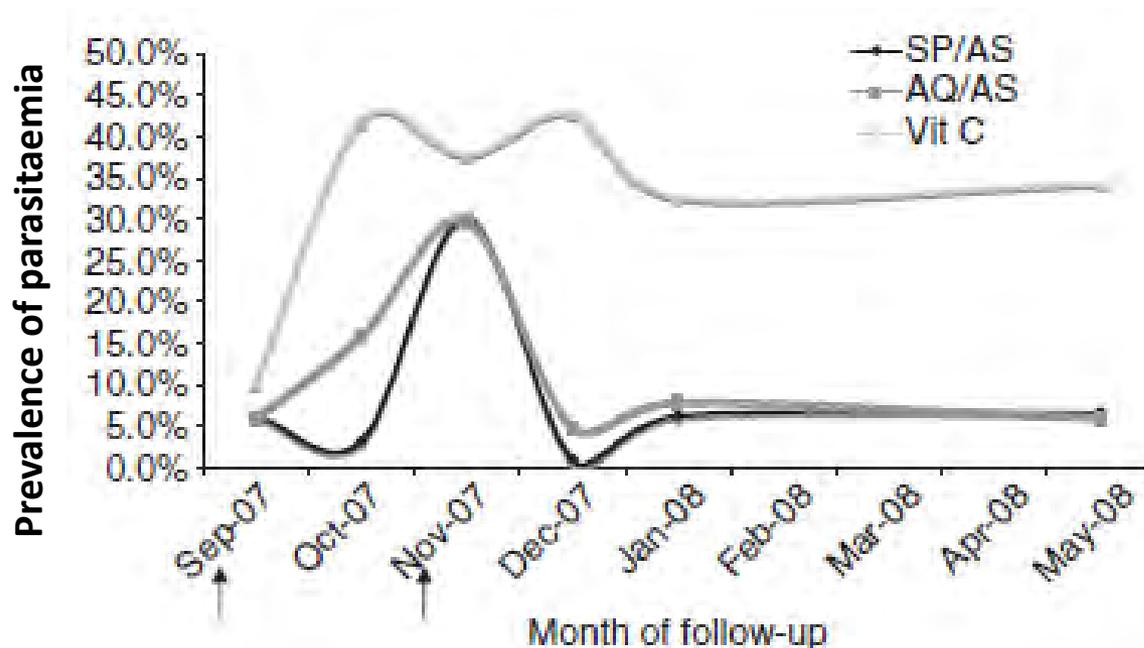
RR 0.45 (CI 0.22-0.94)

55% Protection (CI 7-78%)

$p < 0.01$

Impact of seasonal IPT on clinical malaria among school-aged children in Mali

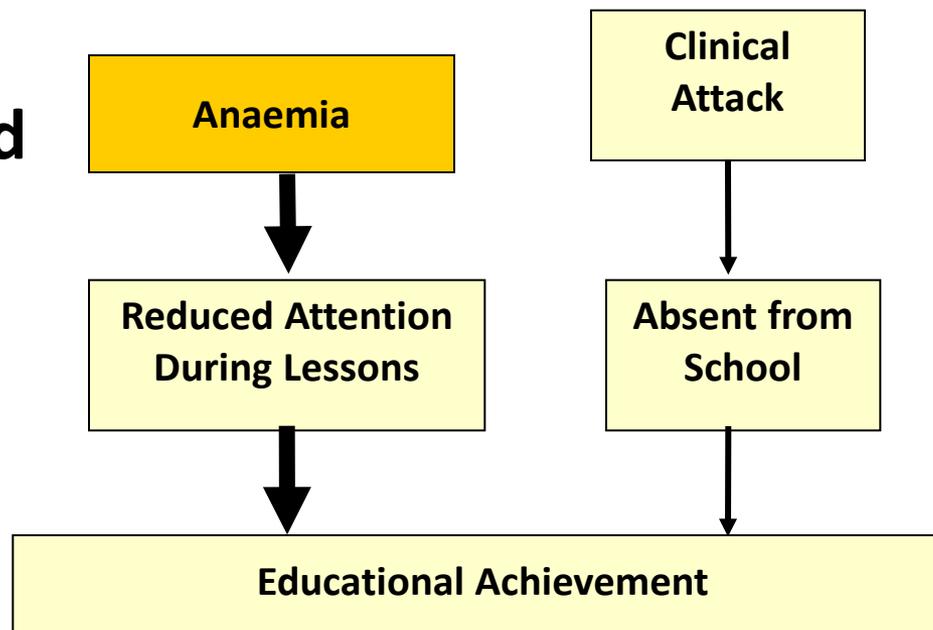
- Individual randomised evaluation among 6-13 year olds
- Three arms: SP plus artesunate (SP/AS); Amodiaquine plus artesunate (AQ/AS) ; Vitamin C. 2 doses given 2 months apart during malaria season, Sept-Dec
- 48-66% reduction in clinical malaria and five-fold reduction in parasitaemia



Barger et al. 2009

- However, protection against clinical malaria & anaemia only lasted 2 months

Impact of IPT on sustained attention and education in the Kenya study



Outcome	n	Mean difference	95% CI	p-value	Effect size
Counting sounds (max score=20)	481	2.12	(-0.17, 4.42)	0.07	0.65
Code transmission (max score=40)	469	7.74	(2.83, 10.65)	0.005	1.01
Exam score 6	286	0.55	(-2.26, 3.36)	0.35	0.15
Exam score 7	266	0.69	(-0.93, 2.15)	0.21	0.30

Possible reasons for lack of observed educational gains

- Low mean scores and low statistical power due to greater than expected clustering
- Insufficient period of instruction to learn effectively during the time course of the evaluation
- Children were not given the educational resources (such as textbooks or quality instruction)
- May be necessary to improve teaching methods in order to capitalise on any improvements in health status of school children following malaria control

Health and Literacy Intervention (HALI) project: **A randomised impact evaluation of malaria prevention and literacy instruction on the Kenyan coast, 2009-12**

Specific objectives, to evaluate :

1. Impact of malaria prevention in improving anaemia
2. Impact of malaria prevention in classroom attention, school attendance and educational
3. Impact of enhance literary program in improving early grade reading
4. Determine whether health and education interventions work synergistically

Design: Randomised implementation, 101 schools in four groups

<http://web.me.com/dubeck/Site/Karibu%21.html>

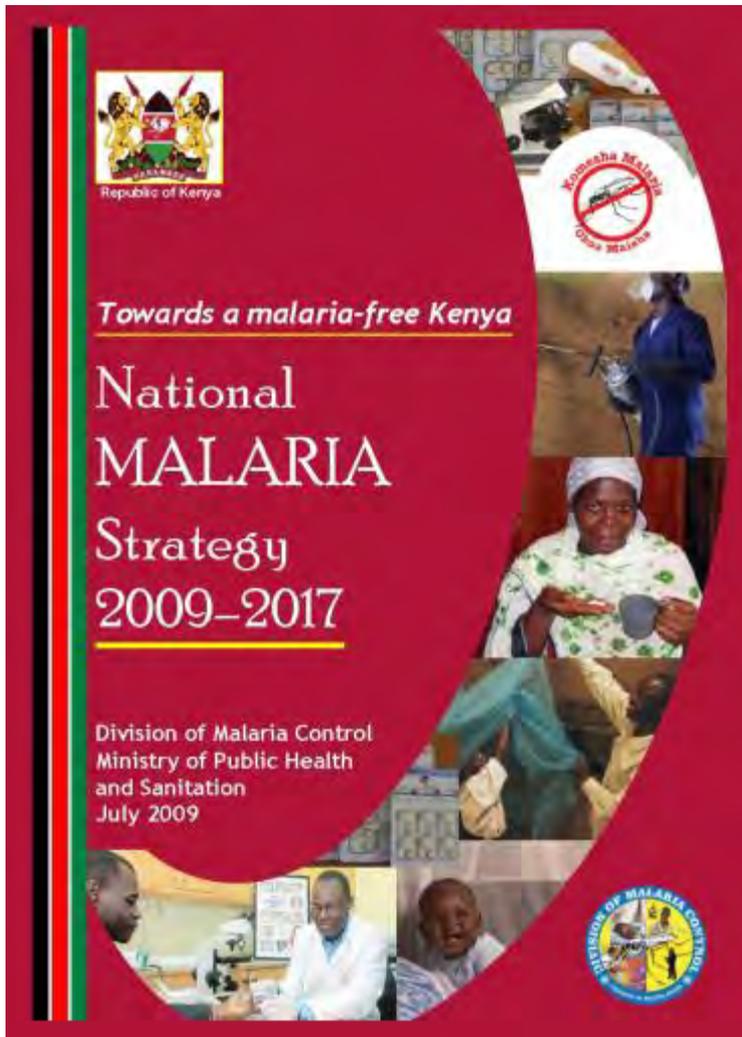
Intermittent Screening and Treatment (IST)

1. Mobile health teams screen children for *P. falciparum* infection once a term using a Paracheck rapid diagnostic test

2. Infected children (symptomatic or asymptomatic) treated with the ACT Artemether-Lumefantrine

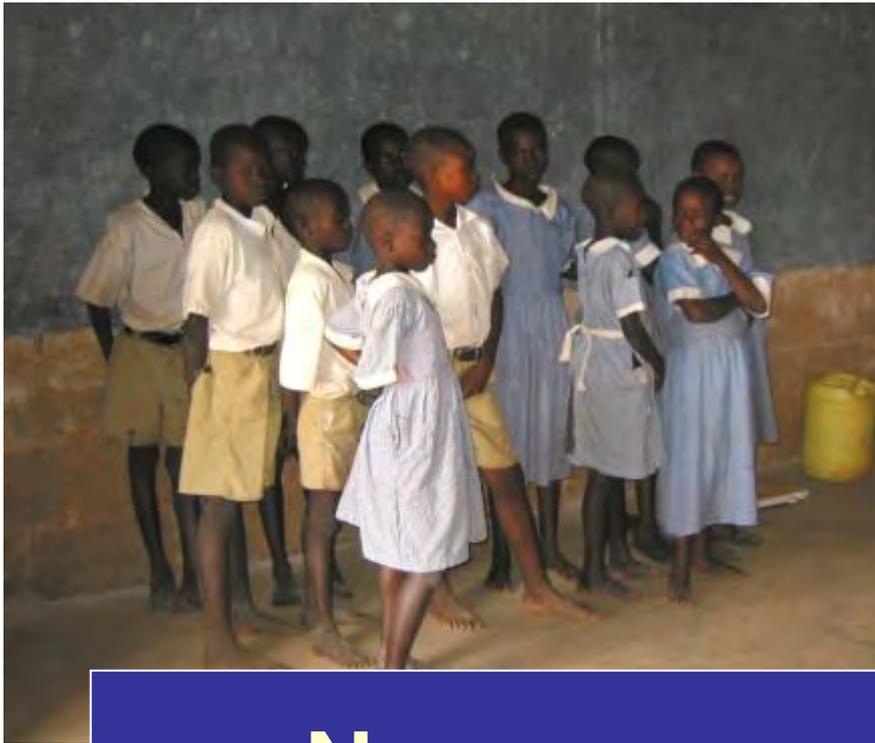


Policy context of IST in Kenya



Malaria Free Schools Initiative

- mainstreaming malaria control in the school curriculum
- indoor residual spraying of schools
- scaling up mosquito net coverage in malaria endemic and epidemic prone areas
- testing and treating all children with parasitaemia according to the national guidelines.



Malaria Control in Schools

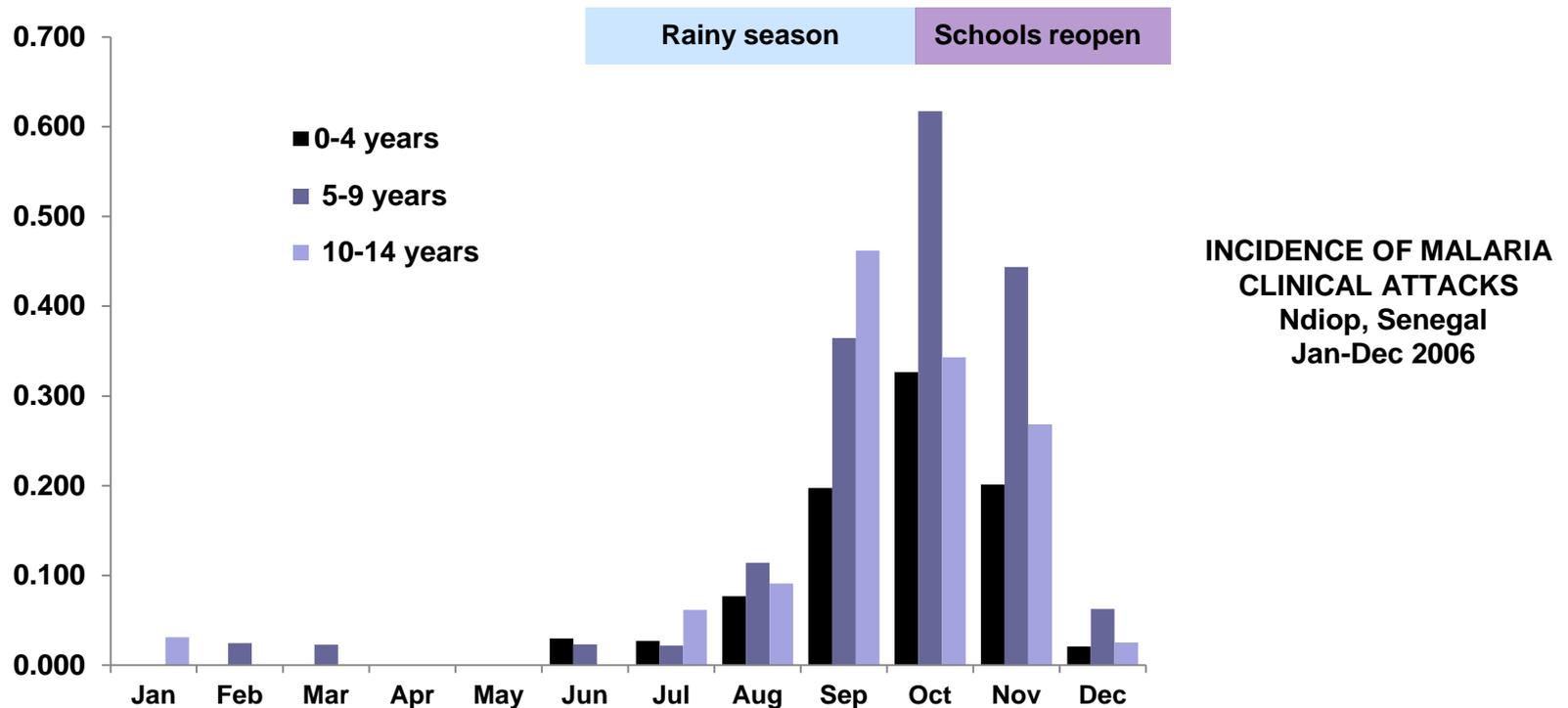
Webinar: 15th June 2012

New approaches in areas of seasonal malaria transmission

Siân Clarke

*Senior Lecturer in Malaria Research and Control,
London School of Hygiene and Tropical Medicine*

Characteristics of areas of seasonal malaria



Distinct epidemiology and disease burden

- Single period of transmission lasting 3-6 months each year
- Immunity acquired more slowly → clinical attacks remain frequent among school-aged children, increased risk of cerebral malaria
- Asymptomatic infections also common, undetected and untreated

Characteristics of areas of seasonal malaria

Distinct epidemiology and disease burden

- Single period of transmission lasting 3-6 months each year
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Opportunity : Possibility for interventions with a short time span

Challenge : Period of highest malaria risk falls over school holidays

Control strategies

- Combination of community-based and school-based approaches
- Complementary strategies:
 - Prevention and treatment of clinical attacks
 - Prevention and treatment of asymptomatic infections

Options for Control

Existing strategies:

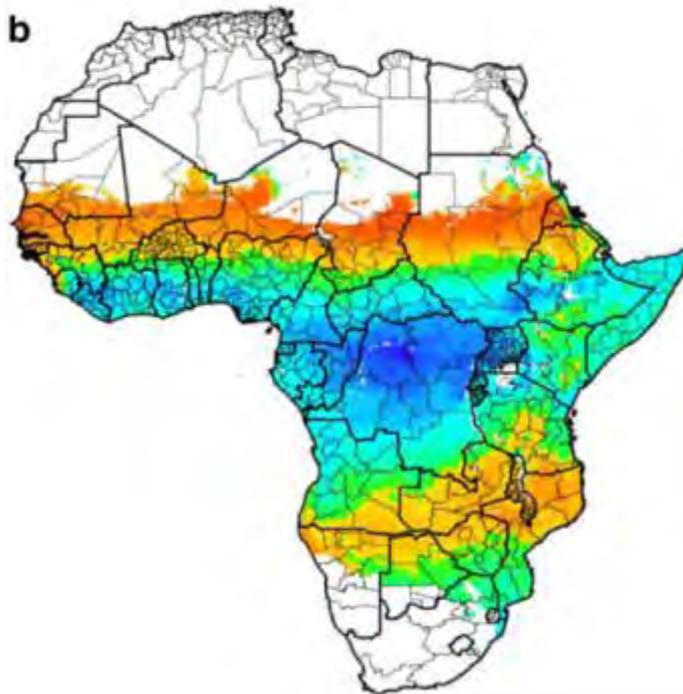
- *Prompt effective treatment of clinical attacks*
- *Insecticide-treated bed nets*

Other potential strategies:

- *Seasonal malaria chemoprevention (SMC)*
IPTc: seasonal intermittent preventive treatment in children,
PSP: prevention saisonaire du paludisme
recently recommended by WHO for areas of seasonal transmission,
March 2012
- *Intermittent parasite clearance (IPC)*

Seasonal Malaria Chemoprevention (SMC)

for *P falciparum* malaria control in highly seasonal transmission areas of the Sahel sub-region in Africa

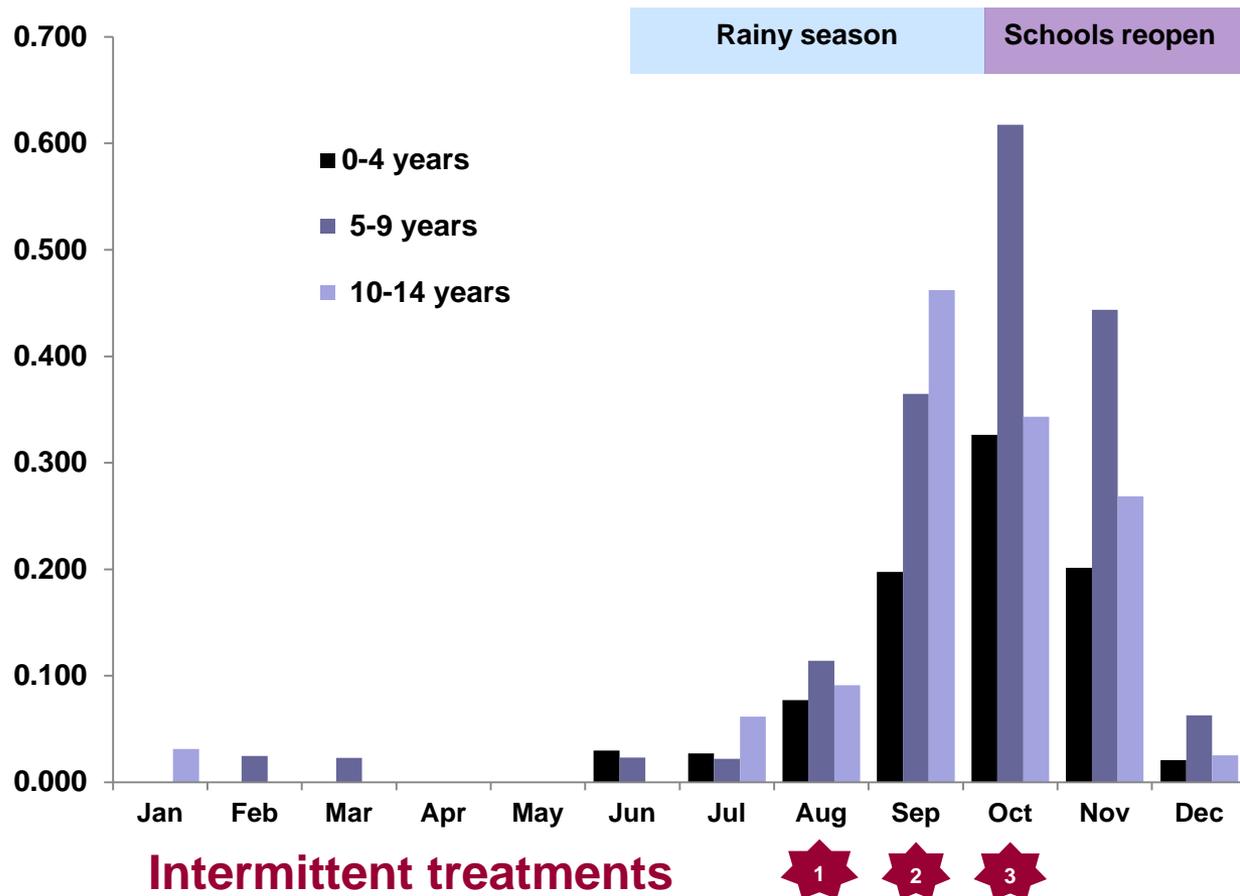


- Intermittent treatment during malaria season to maintain therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk
- SP+AQ: given monthly (max of 4 months)
- Aim: To prevent malarial illness
- Target: Children <5 years of age
- Only recommended for Sahel sub-region, where typically 60% rainfall within 3 months

Expected benefits:

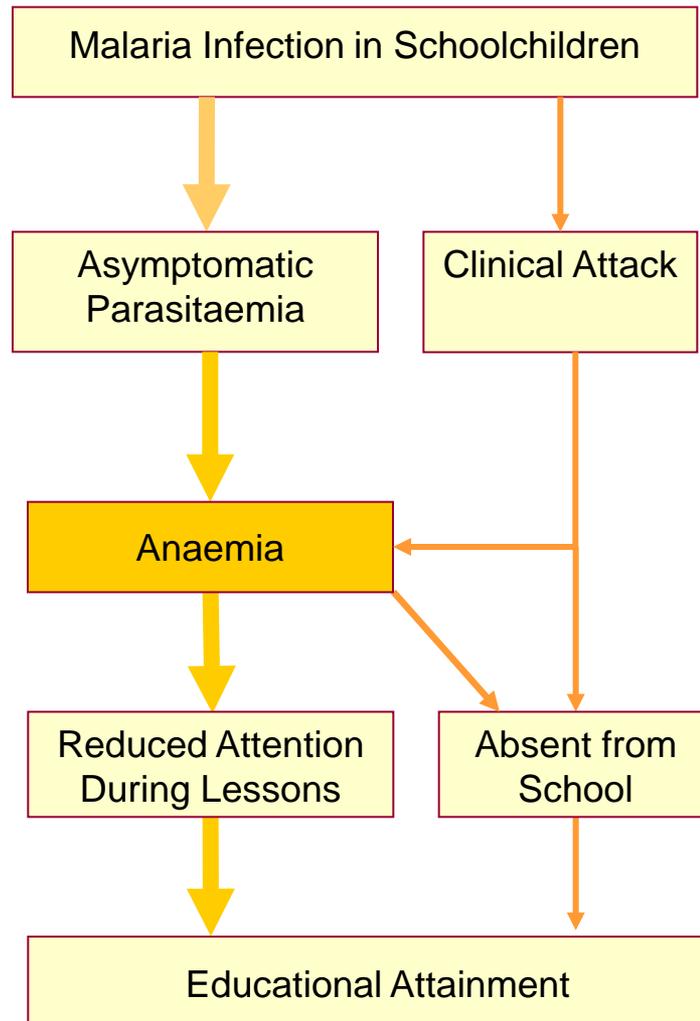
- Prevent 75% all malaria episodes
- Prevent 75% severe malaria episodes
- Probably reduce moderate-severe anaemia
- May decrease child mortality by 1 in 1000

Seasonal malaria chemoprevention

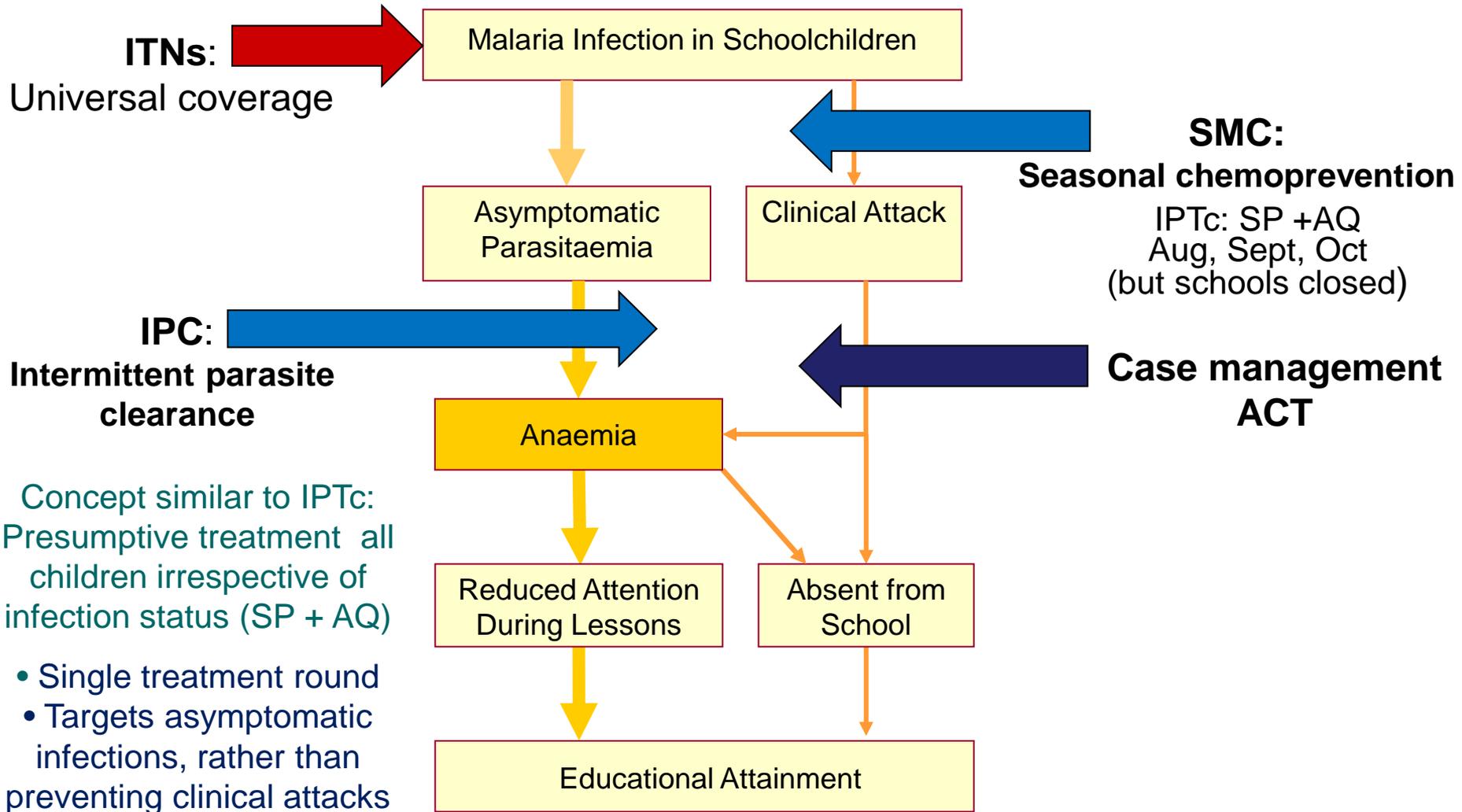


SP+AQ: protection lasts for 4 weeks after treatment

Malaria Control Options in Schools



Malaria Control Options in Schools



Roles for schools in malaria control

Existing strategies:

- *Prompt effective treatment of clinical attacks*
- *Insecticide-treated bed nets*

Other potential strategies:

- *Seasonal malaria chemoprevention (SMC)*
- *Intermittent parasite clearance (IPC)*

- **Health promotion:** conveying key messages
- **Distribution of ITNs:** (universal coverage – what role can schools play to support community-based distribution, keep it up campaigns?)
- **Diagnosis and treatment / Prevention of clinical attacks (SMC):**
limited role since incidence peaks during school holidays
- **Intermittent parasite clearance** – focuses on asymptomatic infections, most common in older children, can be delivered through school, single Tx

Impact of insecticide treated nets among schoolchildren



Two countries with highly seasonal transmission
Recent policy: Universal coverage of LLINs

Kedougou, Senegal

- *Universal net distributions in July 2010*
- *99% schoolchildren reported use of nets*
- *32% asymptomatic malaria infections in Nov 2010*
- *26% anaemic (Hb<11g/dL)*



Sikasso, Mali

- *Save ITN distribution & promotion in schools in 2010*
- *Universal net distributions in April/May 2011*
- *80% schoolchildren reported use of nets*
- *86% asymptomatic malaria infections in Nov 2011*
- *54% anaemic (Hb<11g/dL)*

Intermittent Parasite Clearance: Current Trials



Two countries with highly seasonal transmission
Recent policy: Universal coverage of LLINs

Senegal, West Africa (*LSHTM*)

- *Universal net distributions in July 2010*
- *Individually randomised trial of IPC (Nov 2011), analysis ongoing*



Mali, West Africa (*Save the Children*)

- *Cluster randomised trial of ITN distribution and promotion in schools in 2010*
- *Universal net distributions in April/May 2011*
- *Additional IPC intervention in schools in Nov 2011*

**Research aim: Is there additional impact of IPC given in schools at end of transmission season?
Impact on malaria, anaemia & cognitive function**

Acknowledgements: Collaborating partners in Senegal



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Ministère de la Santé et de la Prévention:
Programme National de Lutte contre le Paludisme



Ministère de l' Education:

- Division du Contrôle Médical Scolaire
- Institut National d'Etude et d'Action pour le Développement de l'Education

**The benefits of school-based health and nutrition
interventions in sub-Saharan Africa:
The case of Mali**



Partners

Implementing partners

Save the Children, USA

National Institute of Public Health, Mali

National Malaria Program, Mali

Academic partners

London School of Hygiene and Tropical Medicine, UK

Harvard University, USA

Centre National de la Recherche Scientifique, France

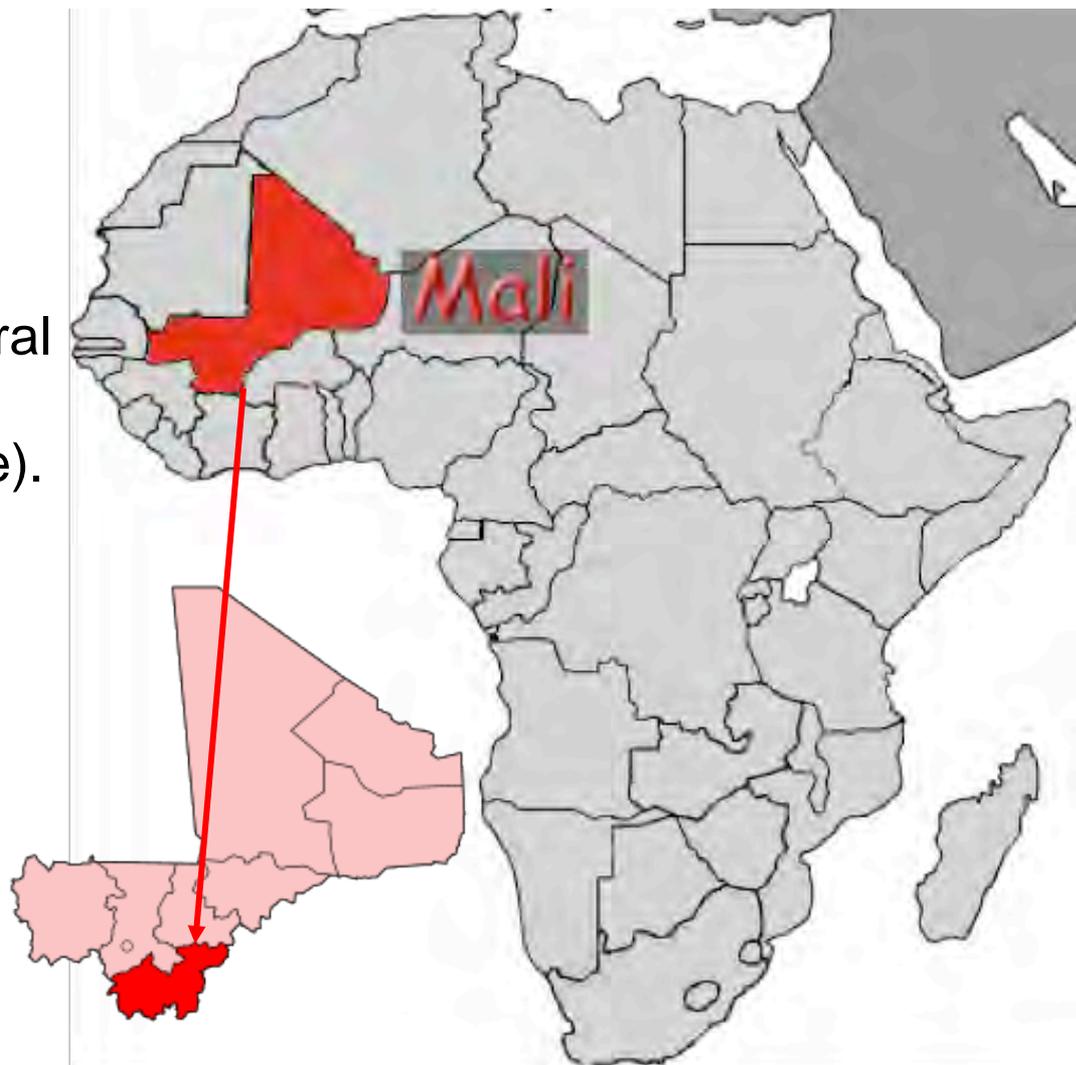
Country background & study site

Mali

- Population : 15.4 M
- ~64% of Malians live on less than \$1 a day
- Malaria is endemic in the central and southern regions (where about 90% of the population live).

Sikasso Region

- ~ 800,000 inhabitants
- Malaria transmission is concentrated in a single season that lasts for 6-7 months of the year



Methodology: Study design

80 villages randomly selected in the Cercle de Sikasso



40 control villages: National universal net distribution

40 intervention villages: National universal net distribution alongside school-based malaria interventions

Malaria education in schools



Free bed net distribution Intermittent parasite clearance (IPC)



Baseline results, November 2010

- **80% (1,381) infected with *P. falciparum***
 - Up to 94% in some schools
 - Less than 5% clinical cases
- **65% (1,209) had anaemia**
 - Up to 80% in some schools
 - Significantly associated with parasite density, stunting, and latrine ownership
- **42% reported sleeping under a net the previous night**

Intervention 1: Malaria education

- Development of pedagogical materials
- Teacher training workshops
- Activities and lessons for children
 - Skits/songs, quizzes, take-home activities



Intervention 2: Malaria awareness days

- Organization of 'malaria awareness days' at each school
- Students and community members performed songs and skits
- Demonstrations of proper net use
- Distribution of two nets per child



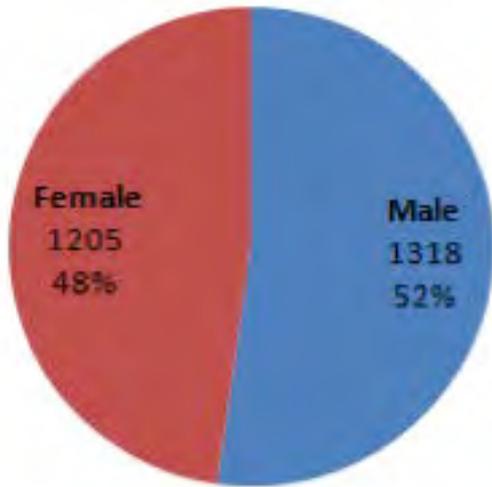
Intervention 3: IPC with Artescospe



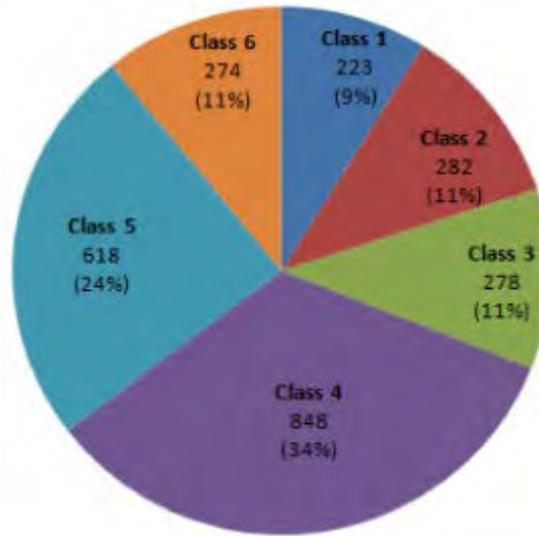
- Participation of local health authorities and national malaria program
- Training workshop held to instruct teachers on how to administer treatment
- Treatment administered over the course of 3 days by head teachers and Save the Children field agents



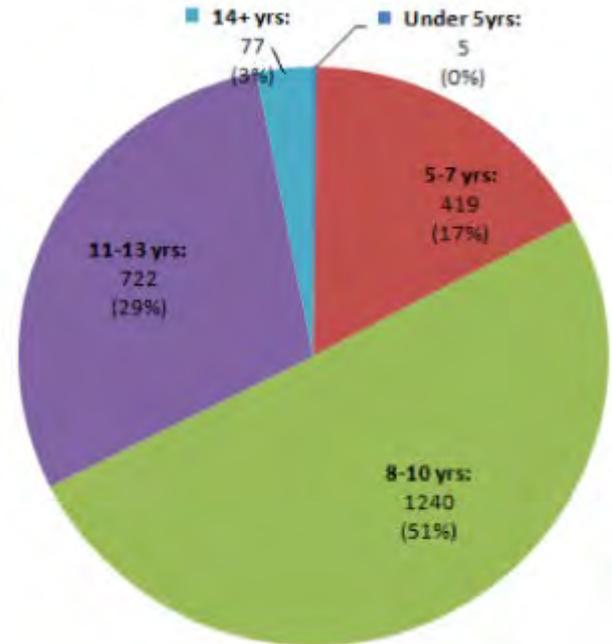
Results: Distribution of sample at baseline



By gender



By class



By age

Results

Baseline

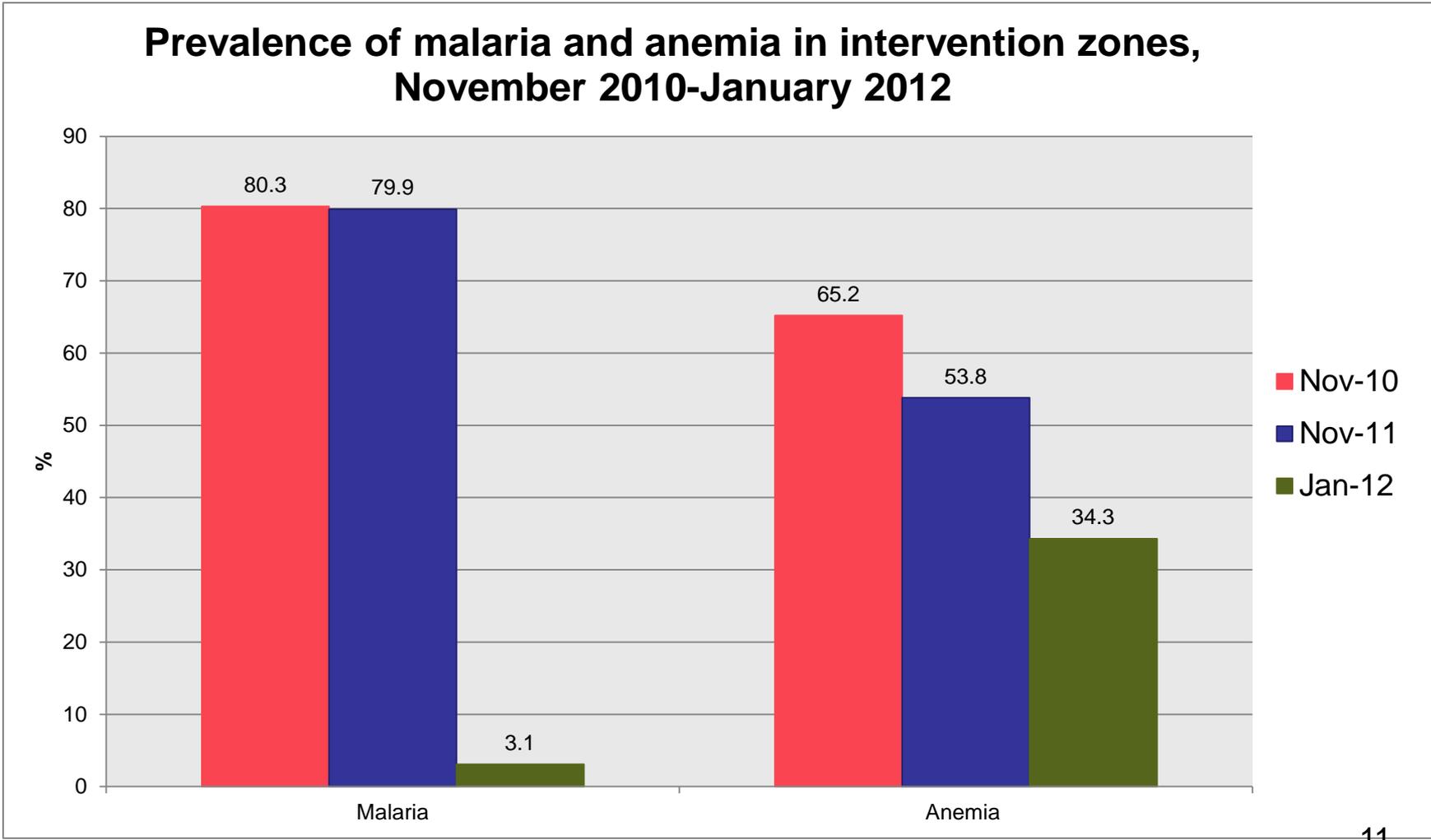
- Extremely high prevalence of malaria (80%) and anemia (65%)
- 42% of students reported sleeping under a net

Impact of Intervention 1 (Malaria lessons & net distribution)

- Knowledge of malaria transmission and prevention was significantly higher among students who received the intervention ($p < 0.001$)
- Reported net use among students (98%) and their families also increased dramatically ($p < 0.001$)
- Malaria prevalence among students in intervention zones was 79.9% significantly lower than in control zones (85.5%, $p < 0.001$)
- There was no significant difference between the prevalence of anemia in either group ($p = 0.788$)



Results: Changes in biomedical indicators



Advantages (I)

With minimal incentives, teachers were engaged and effective

- Trusted by students and the community
- Able to exploit existing channels to organise large-scale activities



Advantages (II)

Significant improvements in intervention schools:

- Increased knowledge of malaria transmission, prevention, symptoms, and treatment among schoolchildren
- Increased reported net use among students after malaria awareness days
- Sustained efficacy of IPC
 - Malaria: 96% after 8 weeks, 88% after 6 months
 - Anaemia: 30% reduction compared with baseline at both 8 weeks and 6 months

Challenges

- Teacher absenteeism during training sessions
- Student absenteeism during treatment may lead to incomplete courses
- Risk of exclusion of sickest and poorest students, who are less likely to attend school
- Net promotion and distribution alone did *not* significantly reduce malaria or anaemia in the population- questions of net efficacy, reported use versus actual use, mosquito or parasite resistance, etc.



Thank you!