



Malaria control in schools in Mali:

**Results from a Cluster Randomized
Control Trial in Sikasso Region, Mali**



Save the Children

Malaria in school age children: Why is it important?

Children under the age of five years and pregnant women are the primary targets for most malaria control programs. These populations experience the most acute symptoms of malaria, and cases are more likely to result in mortality. However, school-age children are the age group most commonly infected with malaria parasites. These infections are usually asymptomatic, so go undetected and thus never get treated. School age children are also least likely to sleep under a mosquito net and thereby are not only themselves the most exposed to malaria risk, but also contribute to onward malaria transmission to others in the community. If untreated, these infections can result in anemia and reduce children's ability to concentrate and learn in school.¹ Previous research on the effect of malaria on education in Mali found that malaria was the main cause of school absenteeism and that both asymptomatic and clinical malaria affect children's school performance.² Furthermore, a high prevalence of malaria infection in the communities was associated with a higher level of school repetition.³ Malaria also remains one of the biggest killers of school age children, estimated to cause up to 50% of all deaths in this age group in Africa.⁴ Yet, while countries continue to strive to reduce and eventually eliminate malaria, school-age children, which represent 26% of the population in Africa, are the least likely to sleep under mosquito nets or seek treatment, can no longer be ignored.

Malaria control in Mali

Malaria is one of the most serious public health problems in Mali. It accounts for 37.5% of health clinic consultations and 72% of deaths amongst children under 5 years and is the main cause of anemia amongst pregnant women.⁵ Sikasso region has the highest burden of malaria because it has the longest rainy season and malaria transmission period, which lasts between 4-6 months.

The goal of the national Malaria control program⁶ in Mali is to reduce malaria related morbidity and mortality by 80% by 2015 from 2005 rates, by ensuring: universal coverage of Long Lasting Insecticide Treated Nets (LLINs) and prompt diagnosis and treatment of malaria; and by developing community-based interventions to bring prevention, diagnosis and treatment closer to the household. The Ministry of Education's recently approved national school health policy aims to create a health system in schools which promotes school children's health.

Although both policies include opportunities for integrating malaria control in schools and a focus on school age children, until today, there has been insufficient evidence to inform specific strategies and interventions for schools in Mali. The research presented below, funded through Save the Children's Child Sponsorship resources with additional support from the Wellcome Trust, contributes to the evidence base needed to advance malaria control in schools in Mali.

- School age children is the population group most likely to be infected with malaria
- 80% of school age children in Sikasso are infected with malaria
- Most cases are asymptomatic and therefore never get treated
- Malaria causes anemia which reduces children's capacity to concentrate and learn

Malaria control in Schools in Sikasso Region

Between October 2010 and May 2012, Save the Children in partnership with the National Malaria Control Program (NMCP), the National Institute for Public Health Research (INRSP) in Mali, the London school of Hygiene & Tropical Medicine (LSHTM), and the National Center for Scientific

Research (CNRS) in France conducted a cluster-randomized control trial to evaluate the impact **of two school based malaria control interventions in the Sikasso region, where Child Sponsorship programs are implemented:**

1) School based malaria prevention education, combined with a school based distribution of Long Lasting Insecticide Treated Nets (LLINs)

- Teachers were trained to conduct **participative malaria prevention education sessions** with their class, to increase children's knowledge of malaria and promote behavior change at household and community level.

The main message that teachers and children promoted were to:

***sleep under a mosquito net every night all year long
even when the rainy season is over.***



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- **Child malaria clubs** were formed in every school to assess and promote net use at the household level.
- **A school malaria day** was organized to coincide with the LLIN distribution. The entire community was invited and children performed sketches, poems, songs and demonstrations on how to hang and use the mosquito nets. Each school child also received two LLINs (for himself and for his siblings).



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2) Intermittent (malaria) Parasite Clearance (IPC)

All school children regardless of infection were given a three day treatment for malaria at the beginning of the school year, which coincided with the end of the high malaria transmission season (November). Artemisinin Combination Therapy (ACT), ARTESCOPE (Artesunate/Sulfadoxine /Pyrimethamine) was used. The treatment was given by trained teachers with oversight by the local health agent and School Management Committee. The main objective of the treatment was to clear all children of malaria parasites at the end of the malaria transmission season, and thereby reduce the prevalence of anemia and improve their ability to concentrate and learn in school.

Research Design

Schools participating in the school-based program received both interventions described above, in a phased approach:

- The malaria prevention education, net distribution and malaria day activities were undertaken in April-May 2011, shortly before the onset of the rains, to promote net use before the the peak transmission period for malaria (June-October).
- In contrast, the Intermittent Parasite Clearance (IPC) was timed for the end of the transmission

season, with the aim that children would remain malaria parasite-free for the rest of the school year (See annex for details).

Eighty primary schools in the commune of Sikasso and outside of Save the Children's programming area were randomly assigned to either the intervention or comparison group. The impact of the intervention was evaluated by comparing health and education outcomes between children attending the 40 intervention schools with those attending the 40 schools in the comparison group, at baseline and after each phase of the interventions (See annex for details).

Results

Baseline results

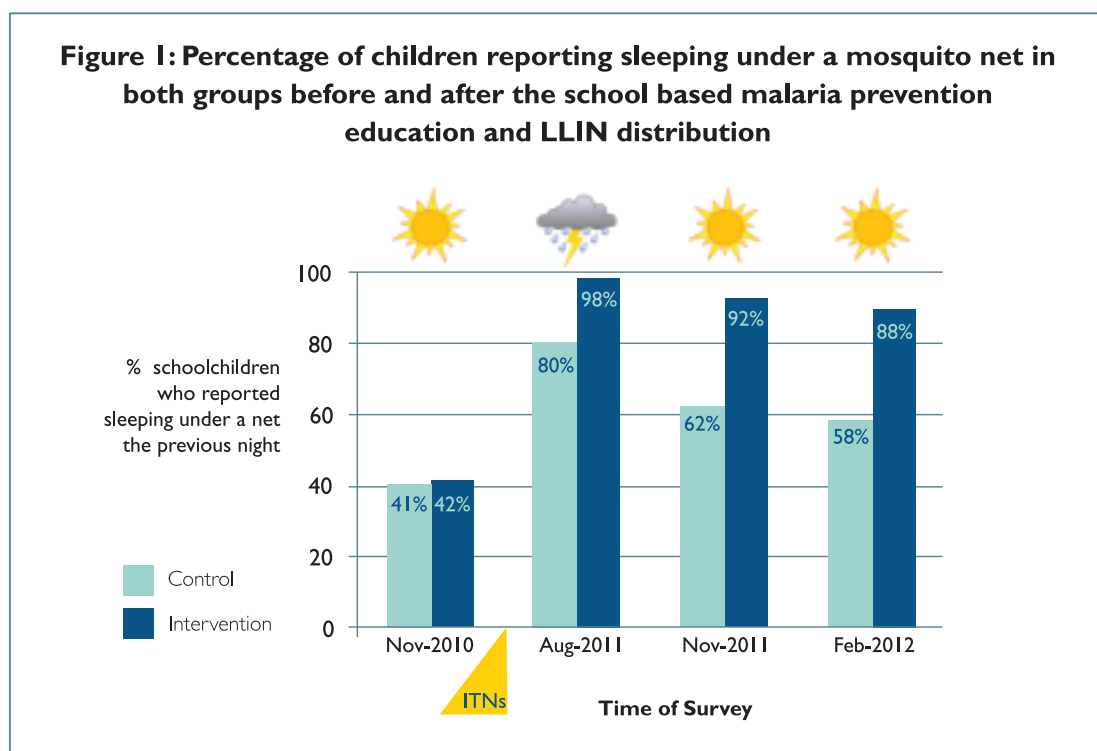
At baseline in November 2010:

- 80% of school children had malaria parasites in their blood (75% were infected with *P. falciparum*)
- 65% were anemic.
- Less than 5% of children infected with malaria had fever. This means that the majority of these infections were asymptomatic malaria.
- Only 42% of school children reported sleeping under a mosquito net the night before the survey.

Phase I results: Impact of malaria prevention education and LLIN distribution

Following the school-based and national universal community-based distribution of LLINs:

- The percent of children reporting sleeping under a mosquito net the previous night increased in both the intervention and comparison schools.
- However, the use of nets improved significantly more amongst children from the intervention schools ($p < 0.001$) and this improvement was sustained for longer. Over 90% of children in the intervention group were still sleeping under a net in November 2011 and 88% in February 2012 (see figure 1 below).
- Children's knowledge of malaria, how it is transmitted, how to prevent it was also significantly higher in the intervention group.



This positive behavior change was also associated a reduction in malaria infections. In contrast with the situation seen 12 months earlier, fewer children in the schools engaged in malaria prevention and education were infected with malaria parasites in Nov 2011 compared to those in the comparison group that had only received LLINs as part of the national program (see Figure 2, next page).

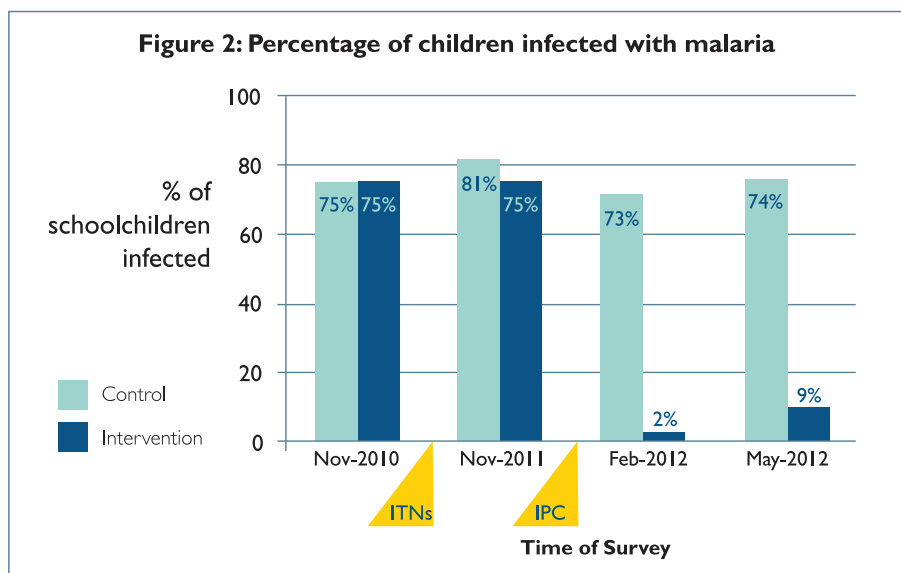
Phase 2 results: Impact of school-based Intermittent Parasite Clearance

The addition of Intermittent Parasite Clearance had a dramatic impact on both the prevalence of malaria and anemia. What's more, this impact was sustained for six months, until the end of the school year (May).

IPC clears children of malaria parasites for six months

In February 2012, two months after the IPC, less than 3% of treated children had malaria compared to 73% in the untreated comparison group. In May 2012, six months after the IPC, the prevalence in the intervention group was still only 9% compared to 75% amongst untreated children (see Figure 2). The IPC thus reduced the risk of malaria infection by close to 99%.

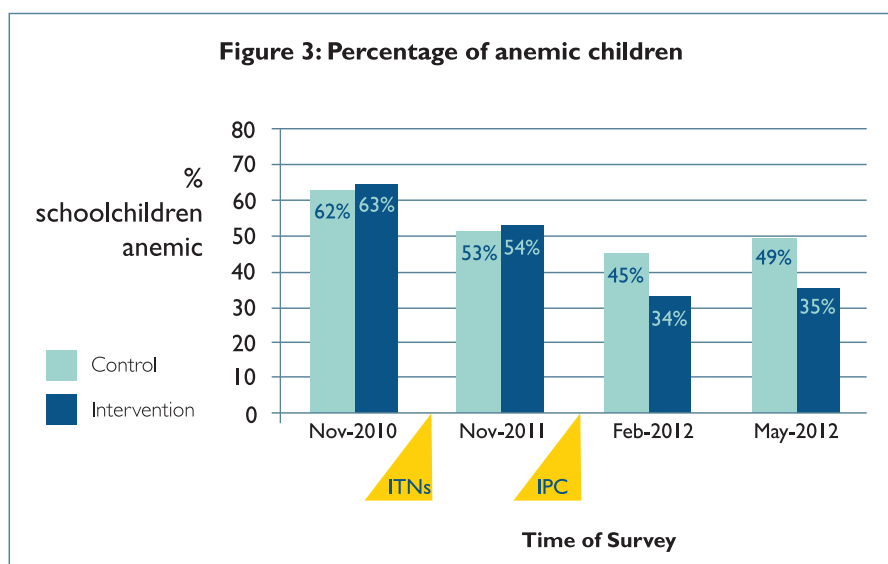
Results also showed that the percentage of children with gametocytes, the form of malaria parasite that can infect other people, was significantly lower in the intervention group (0.8%) versus the non-treated group (7.6%) which is important at a time when the rainy season and malaria transmission season is about to begin.



IPC reduces the risk of anemia for six months

The prevalence of anemia was also substantially lower in the intervention group, two and six months after treatment compared to the untreated children. The prevalence of anemia fell from 63% at baseline to 34% in February 2012 and it remained at this level until May 2012 (see Figure 3).

In comparison, although the prevalence of anemia in the comparison group also fell over the course of the study, 45% of schoolchildren in non-intervention schools were found to be anemic in February 2012; and 49% were anemic in the group of untreated control schools surveyed in May 2012. The IPC thus reduced the risk of anemia in schoolchildren by approximately a third.



IPC improves children's ability to pay attention in class

Children's ability to concentrate on a task and sustain their attention for a fixed period of time was also found to be significantly higher amongst children in the intervention schools compared to those in the comparison schools.

The impact of the intervention on pupils' performance in tests of mathematics and language will also be examined. This analysis is not completed and results are not yet available.

How much does it cost?

A cost analysis was conducted for each intervention. The IPC was estimated to cost \$2.72 per child treated, with personnel costs (teachers, health agents and Save the Children staff) representing 56% of this cost and the drug, 35%. If the IPC drug were changed to the Sulphadoxine-pyrimethamine (SP)/Amodiaquine (AQ) combination, as recently recommended by WHO for malaria prevention in children, the cost could be further reduced. The malaria prevention education in school was estimated to cost \$2.13 per child, with human resources (teachers, trainers and Save the Children staff) representing 92% of the costs. If the teacher training were integrated into a larger in and pre-service teacher training, the cost could also be significantly reduced.

What do children and communities think?

A qualitative survey in 12 communities (six intervention and six comparison) targeting children, parents, school management committees, district level health agents and maires revealed that the interventions were overall very much appreciated

by all stakeholders: the school LLIN distribution was most popular amongst community members because they felt it benefitted the entire household, rather than just the school child. The perception was that the IPC had reduced the number and severity of clinical attacks of malaria, malaria related symptoms at school and school absenteeism:

"I have noticed a reduction in the rate of absentees in my class and in the whole school this year compared to other years" Teacher

The malaria prevention education also seemed to be influencing behaviors in the home:

"When I decide to make members of my family sleep outside because of the heat, one of my children who is at school reminds me to attach the LLIN outside too. He has reminded me of this more than 6 times since the rainy season"

Member of the School Management Committee

Conclusions and recommendations

The findings of this study are very relevant both for malaria control and educational goals in Mali:

- They highlight the high prevalence of mostly asymptomatic malaria amongst school age children (80%) who constitute nearly a third of the population and the need to target school age children in malaria control efforts.
- They show that schools can play an important role in promoting the use of LLINs by school age children and more broadly in the community, particularly alongside a universal LLIN distribution campaign.
- By treating all children for malaria at the beginning of the school year, schools can clear children of malaria for the entire school year, reduce their risk of becoming anemic and improve their ability to pay attention and learn in class.
- Intermittent Parasite Clearance, combined with malaria prevention education at school are affordable scalable solutions for Mali.

Annex: Study methodology and timeline

	COMPARISON 40 schools	INTERVENTION 40 schools	Methods of Evaluation
Nov 2010			Baseline Survey in Schools: Malaria, anemia, cognitive and educational tests before intervention
Jan-April 2011		Phase I Intervention Malaria prevention education and school LLIN distribution	
April 2011	<i>National community based LLIN Distribution^{*(1)}</i>		
Aug 2011			Household Survey: to assess impact of LLIN and education intervention on reported mosquito net use during the rainy season
Nov 2011			School Survey follow up 1: to assess impact on reported net use, malaria, anemia, cognitive and educational tests by the end of peak malaria transmission season
Nov 2011		Phase 2 Intervention Intermittent Parasite Clearance (IPC)	
Feb 2012			School Survey follow up 2: to assess impact of IPC on reported net use, malaria, anemia, cognitive and educational tests
March 2012	Comparison schools receive LLINs, malaria prevention education and parasite clearance ^{*(2)}		
May 2012			School Survey follow up 3: Malaria and anemia tested in a sub set of 5 intervention schools and 5 non study schools ^{*(3)} to assess how long improvements in health status might last
Nov 2012			Community Survey: Qualitative interviews to evaluate community and school perceptions of the school-based interventions

* Note (1): A national universal LLIN distribution campaign was rolled out across all study communities soon after the school based LLIN distribution which removed the comparison group for the school based LLIN distribution. Phase I was then focused on the role of the school to promote LLIN use alongside a national LLIN distribution campaign.

* Note (2): the comparison schools benefitted from both interventions after the survey: Children received the LLINs, malaria prevention education and the Intermittent Parasite Clearance in March 2012.

* Note (3): the Follow up survey 3 was conducted in 5 intervention schools and 5 non study schools (total of 493 students), since the control schools had been treated) to assess the extent to which the IPC conducted in November had been sustained until May



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