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Quasi-experimental study to estimate the effectiveness of seasonal malaria chemoprevention in South Sudan

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In South Sudan, seasonal malaria chemoprevention reduced malaria in children during the high transmission season, despite potential high levels of resistance.

Introduction

Seasonal malaria chemoprevention (SMC) is effective in preventing malaria in children, particularly in areas where transmission is seasonal. Due to concerns about sulfadoxine-pyrimethamine (SP) resistance in East and southern Africa (ESA), SMC has primarily been implemented in the Sahel region of West and Central Africa. However, there is growing evidence that suggests SMC with SP and amodiaquine (AQ) retains a high level of effectiveness in ESA. This study assesses the effectiveness of SMC when delivered under programmatic conditions with unknown antimalarial drug resistance in Northern Bahr el Ghazal, South Sudan.

Methods

- We conducted a non-randomised quasi-experimental study that compared an intervention county (Aweil South) with a control county (Aweil West).
- In Aweil South, five SMC cycles were implemented between July and November 2022, targeting 18,514 children 3–59 months.
- Data were collected through repeated cross-sectional household surveys of caregivers of children 3–59 months using cluster samplings. The wave 1 survey was conducted in both counties prior to the implementation of SMC. Subsequent surveys, waves 2 and 3, were conducted after the second and fourth monthly SMC cycles.
- A difference-in-differences approach was employed by fitting logistic-regression models that incorporated interactions between the county and the wave.

Results

- A total of 2,760 children were sampled across both counties during the three survey waves.
- Children in the intervention arm had 70 percent lower odds of caregiver-reported fever in comparison to those in the control arm (odds ratio [OR]: 0.30, 95 percent confidence interval [95% CI]: 0.12–0.70, p=0.003).
- The odds of caregiver-reported malaria confirmed by a rapid diagnostic test were 82 percent lower during the previous one-month period prior to wave 2 (OR: 0.18, 95% CI: 0.07–0.49, p=0.001) and wave 3 (OR: 0.18, 95% CI: 0.06–0.54, p=0.003).
- Results indicate that SMC is an effective intervention for malaria prevention in eligible children in the study area.

Conclusion

This study suggests SPAQ is effective in reducing malaria in SMC campaigns during the high transmission season in Aweil South, Northern Bahr El Ghazal, South Sudan. These findings are consistent with evidence of SMC's effectiveness reported in previous randomised studies. Despite these results, a comprehensive evaluation of the suitability of SMC for this specific context necessitates the inclusion of results from chemoprevention efficacy cohort studies, along with an analysis of relevant resistance markers.

Results

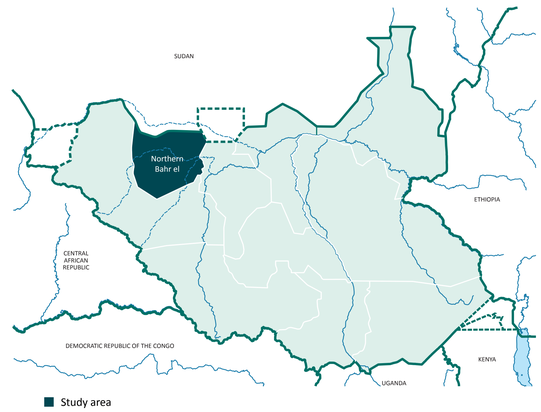
Table 1: Caregiver-reported fever outcomes

Outcome	Model description	Variable	Category	Odds ratio	95% CI	p value
Caregiver-reported fever outcomes	Model 1: Unadjusted model	County	Aweil South (intervention)	0.27	0.10–0.70	0.008
		Wave	Wave 2	2.78	1.77–4.37	<0.001
			Wave 3	1.44	0.77–2.67	0.246
		Interaction	County*Wave 2	0.29	0.12–0.70	0.007
			County*Wave 3	0.56	0.20–1.54	0.252
	Model 2: Adjusted for child age and sex	County	Aweil South (intervention)	0.26	0.11–0.62	0.004
		Wave	Wave 2	2.60	1.68–4.04	<0.001
			Wave 3	1.39	0.72–2.66	0.315
		Interaction	County*Wave 2	0.29	0.12–0.70	0.007
			County*Wave 3	0.59	0.22–1.59	0.285
	Model 3: Full model	County	Aweil South (intervention)	0.18	0.11–0.62	<0.001
		Wave	Wave 2	2.40	1.68–4.04	0.001
			Wave 3	1.36	0.72–2.66	0.260
		Interaction	County*Wave 2	0.30	0.12–0.70	0.003
			County*Wave 3	0.63	0.22–1.59	0.306

Table 2: Caregiver-reported malaria outcomes

Outcome	Model description	Variable	Category	Odds ratio	95% CI	p value
Caregiver-reported malaria outcomes	Model 1: unadjusted model	County	Aweil South (intervention)	1.10	0.51–2.23	0.807
		Wave	Wave 2	3.61	1.93–6.77	<0.001
			Wave 3	3.32	1.91–5.76	<0.001
		Interaction	County*Wave 2	0.21	0.08–0.55	0.003
			County*Wave 3	0.21	0.06–0.62	0.006
	Model 2: adjusted for child age and sex	County	Aweil South (intervention)	1.10	0.51–2.38	0.803
		Wave	Wave 2	3.61	2.03–6.43	<0.001
			Wave 3	3.31	1.91–5.73	<0.001
		Interaction	County*Wave 2	0.20	0.08–0.54	0.002
			County*Wave 3	0.21	0.07–0.63	0.006
	Model 3: full model	County	Aweil South (intervention)	0.94	0.45–1.93	0.860
		Wave	Wave 2	3.39	1.79–6.43	<0.001
			Wave 3	3.39	1.89–6.08	<0.001
		Interaction	County*Wave 2	0.18	0.07–0.49	0.001
			County*Wave 3	0.18	0.06–0.54	0.003

Figure 1: Map of the study area in South Sudan



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