RESEARCH/POLICY BRIEF

IMPACT OF INTEGRATING THE DELIVERY OF SEASONAL MALARIA CHEMOPREVENTION (SMC) WITH NUTRITION SUPPLEMENTATION IN NORTHERN NIGERIA ON MALARIA AND NUTRITION OUTCOMES

BACKGROUND

Since 2012, the World Health Organization (WHO) has recommended seasonal malaria chemoprevention (SMC) with sulfadoxine-pyrimethamine and amodiaquine (SP-AQ) be delivered to children 3-59 months across the Sahel region of Africa, including nine states in northern Nigeria.[1] In Kano, the most populous of these nine states, malaria accounts for up to 25% of the mortality burden among children under five.[3]

The monthly delivery of SP-AQ to children under five during the rainy season provides an opportunity to bundle distribution with addition public health interventions. Malnutrition is also a major public health crisis among children under five in Kano and doubles the risk of dying from malaria.[4] The 2013 Demographic and Health Survey (DHS) estimated that chronic malnutrition affected nearly half of under-fives in Kano (stunted), and 38% of children were acutely malnourished (wasted).[5]

This study utilized the 2014 SMC delivery campaign in Kano to assess whether integrating SMC with Plumpy'doz™, a lipid-based nutritional supplement (LNS), has an impact on nutrition or malaria outcomes. The pilot investigated three research questions. Among children ages 6-24 months:

- Does integrating the delivery of LNS during SMC campaigns change coverage and adherence within target communities compared to delivery of SMC alone?
- Does integrating the delivery of LNS during SMC campaigns change malnutrition outcomes (stunting, wasting, underweight) compared to SMC alone?
- Does integrating delivery of LNS during SMC campaigns increase protection against clinical malaria compared to SMC alone?

METHODS

From August to November 2014, SP-AQ was delivered door-to-door each month to children 3-59 months of age in seven wards of Madobi Local Government Area (LGA), Kano State by Kano Ministry of Health Community-Directed Distributors (CDDs). In three of the wards, children 6-24 months of age in August also received a lipid-based nutrition supplement (LNS).

Cross-sectional household surveys were conducted in the seven wards at baseline (August 2014), midline (November 2014, following the final round of distribution), and endline (May 2015). Information was collected on demographics, anthropometric measurements, coverage, recent fever history, and adherence to interventions among children aged 6-24 months at baseline. The proportion of eligible children covered and proportion adhering to treatment protocols were measured during the midline survey. Height, weight, and mid-upper arm circumference (MUAC) measurements were recorded in children who were aged 6-24 months in August 2014, 9-27 months in November 2014, and 15-33 months in May 2015. Mean z-scores and prevalence of stunting, wasting, underweight, and low MUAC were estimated using the 2006 WHO Child Growth Standards.

The impact of malaria incidence combining interventions on malaria outcomes was evaluated through an unmatched case-control study. All children aged 6-24 months as of August 2014 consulting for fever in one of the 13 primary health care facilities in the pilot study area between August 28 and December 1, 2014 were recruited. A case was defined as any child eligible to receive interventions (SP-AQ and/or LNS) residing in the study area, with a fever ≥37.5 C within the past 48 hours and a positive malaria rapid diagnostic test. Controls had fever but a negative malaria test. Information was collected on demographics (age, gender, residence), disease history, bednet use, and intervention coverage. The relationship between exposure to SP-AQ and LNS and confirmed malaria was estimated using multivariable mixed-effect logistic regression, adjusting for demographics, facility, month of consultation, and bednet use.

Cost-per-child analysis was also performed for each intervention arm to model actual expected costs.

Acknowledgements

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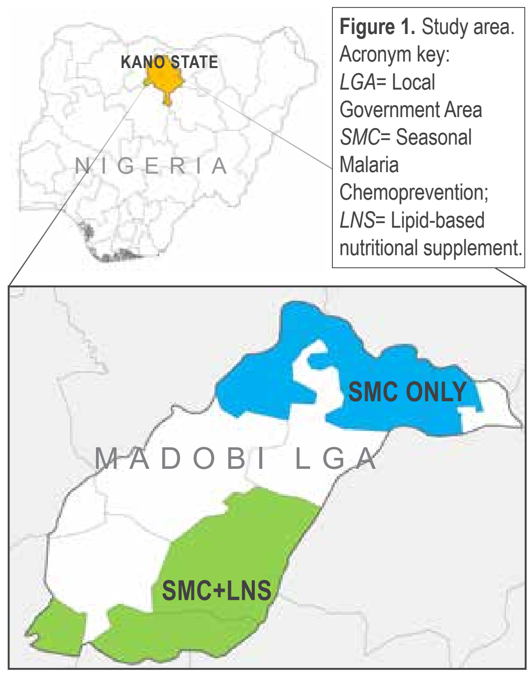

Figure 1. Study area. Acronym key: *LGA*= Local Government Area *SMC*= Seasonal Malaria Chemoprevention; *LNS*= Lipid-based nutritional supplement.

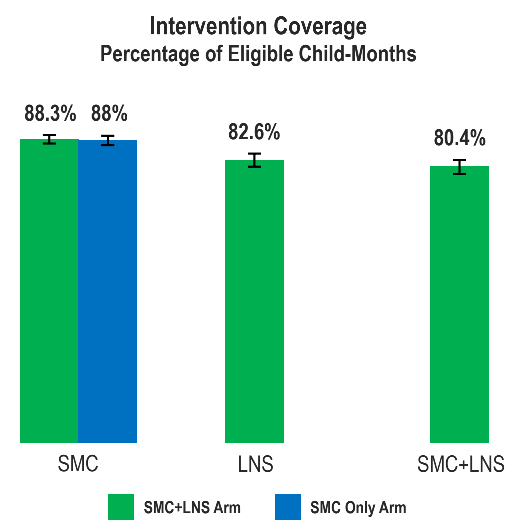

Figure 2. Intervention coverage: SMC coverage out of 5,045 (SMC+LNS Arm) and 4,960 (SMC Only Arm) eligible child-months in children ages 3-62 months; coverage of LNS and both products out of 2,495 eligible child-months in children ages 6-27 months in the SMC+LNS arm.

EFFECT OF INTEGRATING SMC AND NUTRITIONAL SUPPLEMENTATION IN NORTHERN NIGERIA

NUTRITION INDICATORS

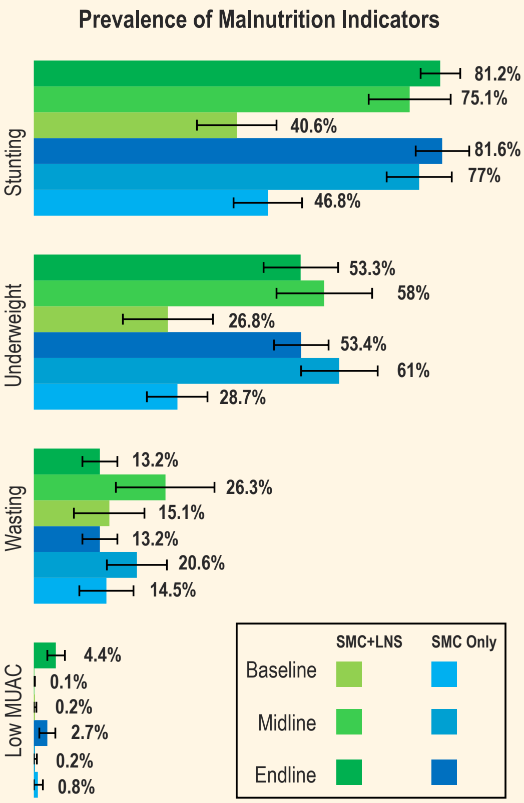

Figure 3. The prevalences of stunting, wasting, and underweight among children who received four doses of commodities were not significantly different between surveys comparing the SMC Only with the SMC+LNS group (p>0.05 for all odds ratios in logistic regression analysis).

COST-PER-CHILD

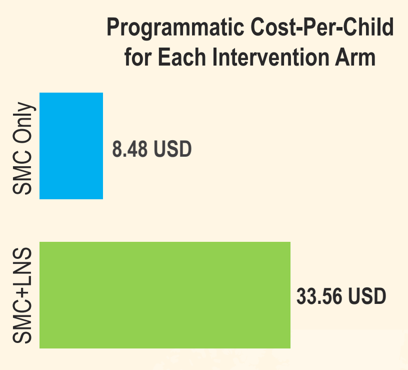

Figure 4. Cost-per-child for each intervention arm, for a full season (four monthly deliveries) of commodities. Costs include product, shipping and fees, advocacy, training of healthcare workers, community sensitization, and community distribution and supervision.

RESULTS

Coverage and adherence: Integrating LNS with SP-AQ did not change coverage (**Figure 2**) and adherence. SP-AQ coverage remained higher than 80% each month in the study area, and adherence to SP-AQ (percentage of children who took the full three-day course) was 83% with no difference between arms (n=1140, p=0.38). Adherence to LNS (percentage of children consuming LNS within 24 hours prior to the survey) was estimated at 57%.

Nutrition outcomes: More than 80% of children in both arms were observed to be stunted (z-score less than -2) at baseline, indicating widespread chronic malnutrition (**Figure 3**). Anthropometric results at midline did not change significantly from baseline for stunting, wasting, or underweight. Between midline and endline, the prevalence of stunting and underweight fell in both groups by approximately 30 percentage points (Chi-2 p<0.001 for both indicators in each arm), possibly due in part to seasonal changes.

Malaria outcomes: A total of 96 cases and 285 controls were recruited. Case-control results provided evidence of an enhanced protective effect of adding LNS to SMC against clinical malaria. Among those who had taken SMC and LNS in the past 30 days, the odds of clinical malaria were 61% lower than among those who received SMC only (OR=0.39, 95% CI: 0.15-0.98).

Costs: Cost-per-child targeted was substantially higher in the SMC+LNS arm (33.56 USD) compared with the SMC only arm (8.48 USD), due primarily to the cost of the commodity (LNS) plus shipping (**Figure 4**).

CONSIDERATIONS FOR FUTURE PROGRAMS

Co-delivery of LNS during SMC campaigns did not have any effect on coverage and adherence to SP-AQ through door-to-door delivery in this study, providing evidence that bundling interventions is operationally a viable strategy to optimize distribution. No impact on nutrition outcomes of LNS distributed during 4 months at the recommended dose was observed in this study but adding LNS during SMC campaigns may offer additional protection against clinical malaria. The study was limited by a cross-sectional design, challenges measuring children in the field, and low case recruitment

Alternative nutrition interventions or public health commodities should be considered for integration with future SMC campaigns to take advantage of the delivery platform and maximize impact on child health outcomes. Referral of children diagnosed with severe acute malnutrition (SAM) may be one low-cost intervention that could be bundled into the program. Other interventions, such as health promotion and/or food practices in households, may also be cost-effective. Alternative interventions to incentivize families to improve their nutrition practices such as vouchers or cash would also be worth investigating. These considerations are especially critical in areas with high malnutrition indicators. In the pilot area, prevalence of stunting, wasting, and underweight were high enough to warrant a continued comprehensive nutrition program.

[1] WHO Global Malaria Programme (2012). WHO Policy Recommendation: Seasonal Malaria Chemoprevention (SMC) for Plasmodium falciparum malaria control in highly seasonal transmission areas of the Sahel sub-region in Africa. Available from: http://www.who.int/malaria/publications/atoz/who_smc_policy_recommendation/en/
[2] WorldPop (2015). www.worldpop.org.uk
[3] Powerpoint, find source
[4] Black RE, Allen LH, et al. (2008). Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences. *Lancet*, 371(9608):243-60.
[5] Nigeria 2013 Demographic and Health Survey. www.measuredhs.com.
[6] LNS was donated by Nutriset for the purpose of this pilot.

This analysis was conducted by the **Clinton Health Access Initiative, Inc. (CHAI).** CHAI works in association with governments and other NGO partners to scale up prevention and treatment programs for a wide range of health issues, including HIV/AIDS, malaria, and maternal and child health. For more information on this analysis, please contact Abigail Ward at **award@clintonhealthaccess.org**