



## Original Article

## Scaling-up Seasonal Malaria Chemoprevention in Niger: Description of the 2016 Campaign

*Mise à échelle de la chimioprévention du paludisme saisonnier au Niger: Description de la campagne 2016.*

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### ABSTRACT

**Introduction.** In 2015, seasonal malaria chemoprevention (SMC) was scaled-up in Niger. The SMC program implementation was well described in other sub-saharan African countries but limited or no literature in Niger. This study therefore aimed to describe the 2016 SMC campaign in Niger. **Methods.** Data provided by Niger National Malaria Control Program (NMCP) and Catholic Relief Service (CRS) was used in this study, to describe the Niger SMC plan, organization of the campaign, plan for communication, monitoring and evaluation activities. Similarly, we estimated the target group and selected eligible areas, SMC coverage, human resource, drug and budget used for 2016 SMC delivery in Niger. **Results.** Of all the 45-health districts (HD) eligible, 39 HD were targeted in 2016, and up to 2,707,742 children were eligible for SMC. The Niger national coverage rate for SMC in 2016 was 85.75%. No severe adverse events were reported. A total of 33,998 human resources were used in the conduct of SMC with total financial cost of the intervention to be 1,027,336,229 CFA francs. **Conclusion.** The 2016 SMC implementation recorded good coverage and significant drugs tolerability in all cycles. SMC is also economically beneficial in reducing morbidity and mortality among under-5. The SMC with sulfadoxine-pyrimethamine and amodiaquine will be a good toll to reduce morbidity and mortality among children under-5 years in Niger.

### RÉSUMÉ

**Introduction.** En 2015, une mise à échelle de la chimioprévention du paludisme saisonnier (CPS) avait débuté au Niger. La mise en œuvre de la CPS a bien été décrite dans beaucoup de pays d'Afrique subsaharienne, mais pas au Niger où peu de données sont disponibles. Le but de cette étude est de décrire la campagne 2016 de la chimioprévention du paludisme saisonnier au Niger. **Méthodes.** : Cette étude décrit la planification de la CPS au Niger, l'organisation de la campagne, le plan de communication, les activités de suivi, d'évaluation. Elle donne une estimation du nombre du groupe cible, les zones éligibles sélectionnées, la couverture de la CPS, les ressources humaines utilisées, des médicaments et le budget utilisé pour l'implémentation de la CPS en 2016. Le Programme National de Lutte contre le Paludisme du Niger (PNLP) et le Catholic Relief Service (CRS) ont fourni les données. **Résultats.** Sur les 45 districts sanitaires (DS) éligibles, 39 DS ont été ciblés en 2016. Sur l'ensemble des DS inclus, 2 707 742 enfants étaient éligibles. Le taux de couverture nationale en 2016 était de 85,75%. Aucun événement indésirable grave n'a été observé. Au total, 33 998 ressources humaines ont été utilisées pour cette campagne. En 2016, le coût financier total de l'intervention était de 1 027 336 229 francs CFA. **Conclusion.** En 2016, la mise en œuvre de la CPS, une couverture élevée et une bonne tolérabilité des médicaments ont été observées dans tous les cycles. La CPS est économiquement bénéfique pour réduire la morbi-mortalité chez les enfants de moins de 5 ans. La CPS avec la sulfadoxine-pyriméthamine et amodiaquine sera un bon moyen pour réduire la morbi-mortalité chez les enfants de moins de 5 ans au Niger.

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**Keywords:** Seasonal Malaria Chemoprevention, Niger.

**Mots-clés :** chimioprévention du paludisme saisonnier – Niger.

### INTRODUCTION

Malaria is a major public health problem in the Sahelian area (WHO, 2017). In Niger, malaria and gastro-enteritis are among the leading causes of infant and under-five morbidity and mortality [1]. To reduce malaria incidence WHO recommended seasonal malaria chemoprevention (SMC) in Sahelian countries [2]. SMC is a new approach of malaria intermittent prevention treatment to children in areas of highly seasonal transmission during season

associated with increased incidence of malaria. SMC has been shown to be safe and highly effective and have a substantial impact on positive child health. In Mali, SMC reduced the prevalence of malaria infection by 85% (95% CI 73%–92%) and in Senegal 86% (95% CI 80–90) reduction in the occurrence of clinical episodes of malaria was observed[3][4].

The epidemiological profile of malaria in Niger is endemic with seasonal recrudescence during the rainy season from June to October. The high mortality is being observed especially among children under five years of age. In Niger, the National Malaria Control Program (NMCP) was developed and implemented with partners in form of national strategic plan for malaria control. The plan aims to improve the performance of the NMCP in monitoring, implementing and evaluating malaria control activities. The main objective of the Niger NMCP is to reduce morbidity and mortality of malaria across the country. SMC is one of the important strategy of the national plan developed by NMCP since 2013[5].

The adoption and implementation of SMC at the national level should involve all relevant stakeholders, including technical and financial partners. The process was conducted by the NMCP, with the participation of health authorities, research institutions and others partners. The impact of SMC was observed after high coverage and several years of implementation in Niger. The communication plan for SMC was developed and integrated into existing programs. In Niger, the social mobilization was done with public criers in rural areas and through the use of Radio and television in urban areas.

SMC implementation was under the supervision of the NMCP for the activities of the medical region (MR); supervision of the MR and NMCP for health district (HD) activities; supervision of HD, MR and NMCP for health centre (HC). Debriefing sessions were held every evening at all levels: HC, HD, MR and NMCP and after each SMC cycle, an evaluation was conducted at all operational levels, thus, the HC evaluated their activities. After the evaluation at the HC level, it was around the HD and then MD. A national assessment meeting was organized at the end of each round of SMC campaign.

In Niger, 12 tools for the implementation of SMC were used for the MR, HD, HC and distribution site. These tools were provided by NMCP before SMC campaign started. The campaigns were integrated into the micro plans of the MR in order to avoid overlapping of activities.

The combination of sulfadoxine-pyrimethamine (SP) and amodiaquine (AQ) used in Niger is in the form of a co-blister containing the two drugs: SPAQ 250 / 12.5 mg + AQ 75mg for children of 3-11 months of age and SPAQ 500/25 mg + AQ 150 mg for children from 12 to 59 months of age. National Pharmaceutical Office (ONPPC) provided the drugs for SMC implementation in the HD. The HD distributed the drug to HC who provide the SPAQ to the distributors.

In May 2013, NMCP of Niger had implemented in five pilot sites located in Guidan Roudji, Bouza, Madarounfa, Madaoua and Magaria in collaboration with "Médecins Sans Frontière" (MSF).4[7],[8] At this pilot step strong correlation between SMC and reduction of malaria episodes was noted ( $R=0.59$ ) as well as the reduction of the incidence of uncomplicated malaria (37%) and severe malaria (26.5%). SMC significantly reduced coma by 13.2%, hospitalizations by 23% and reduced mortality by 48.3%[7].

Since 2015, SMC was scaled-up in 39 DS in Niger. The SMC programs implementations were well described in other sub-saharan countries but there is paucity of data reported from Niger. This study describes the scaling-up of SMC in Niger in 2016 in order to learn from experiences during the campaign and therefore might influence policy makers and other stakeholders in closing the identified gaps while improving on the areas of strengths.

## METHODS

### SMC Selected areas in Niger

The study was conducted in seven administrative regions of Niger (Diffa, Dosso, Maradi, Niamey, Tahoua, Tillabéry and Zinder). In 2016, Niger National Malaria Control Program (NMCP) has identified 45 HD eligible for SMC located in these regions.

Diffa is a city and urban community in the extreme southeast of Niger, malaria meso-endemic area. It had a total population of 623,212 people [9]. The population is 85% sedentary and 15% nomadic. The economy of the Diffa Region is primarily agricultural, based upon pastoralism and farming. Diffa had a total of 315 various categories of human resources for health in 2014. Zinder is situated 861 Km east of capital Niamey, with a population of 3,714,964 (2014 census). The economy of Zinder is based on the agricultural activities. The HD of Zinder had up to 1,377 various categories of human resources for health based on 2014 census. Maradi region is located in the southern border of Niger, with an estimated population of 3,531,574. Maradi is the major transport trade and agricultural hub of Niger's south central Hausa region. In 2014 the total human resources for health was 1,197. The region of Dosso is located in the southwest corner of Niger. It had an official population during the 2014 census of 2,094,090 and 978 various categories of human resources for health. The economy of Dosso is based on the agricultural and commercial activities. Tillabéry region is located in the southwest of Niger, with a population of 2 811 949 and 897 various categories of human resources for health in 2014. The economy of Tillabéry is based on the agricultural and pastoralism activities. Tahoua region is located in the northwest of Niger. It had a population of 3,489,641 with 1,028 various categories of human resources for health (2014 census). Economy of Tahoua is based on agricultural and commercial activities. Niamey is a capital of Niger; it is an administrative, cultural and economic centre. Niamey's population was estimated to be a 1,061,660 as of the 2014 census with 1927 various categories of human resources for health. The HD of Zinder, Maradi, Tahoua and Tillabéry districts were classified as mesoendemic, but Dosso and Niamey as hyper endemic for malaria. In all HD included in this study malaria transmission is seasonal. Both sites used ACTs as first line treatment for uncomplicated malaria and received universal coverage of bed nets.

### Population

Children aged of 3 to 59 months of age are eligible for SMC in Niger according to WHO recommendation.

Were included all children who live in malaria meso-endemic and hyper endemic areas with seasonal transmission in Niger (Figure 1).

#### Data collection

Niger NMCP and Catholic Relief Service provided the data. These data were collected from the SMC delivery registers and SMC cards. The data collected from SMC administration registers included the number of human resources used, coverage, cost, drug used and SMC

delivery. In Niger NMCP planned four rounds of SMC with SPAQ at monthly intervals in July, August, September and November. In all HD fixed-point strategy of delivery was planned for the villages and door-to-door for the urban city, with fifth dose on directly observed treatment. In all HD community health workers, village heads, religious leaders and village/town criers were asked to circulate information within their area.

## RESULTS

### Areas eligible for SMC in 2016

Of all 45 HD eligible, 39 HD were targeted in 2016 (Figure 2). ACCESS-SMC project was the fifth funder of 2016 SMC implementation in Niger. The project covered 19 HD out of 39 eligibles (Table 1).

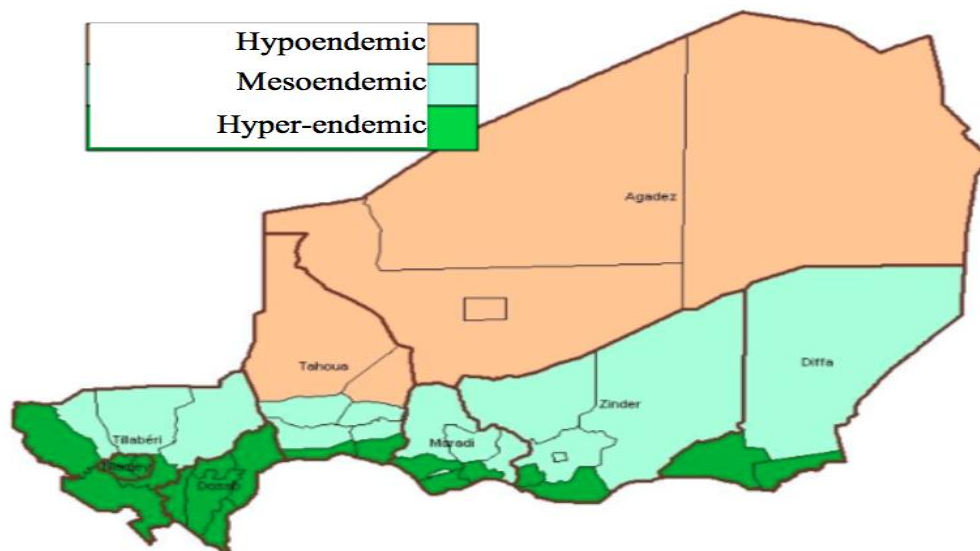


Figure 1: Malaria incidence in Niger (PNLP)

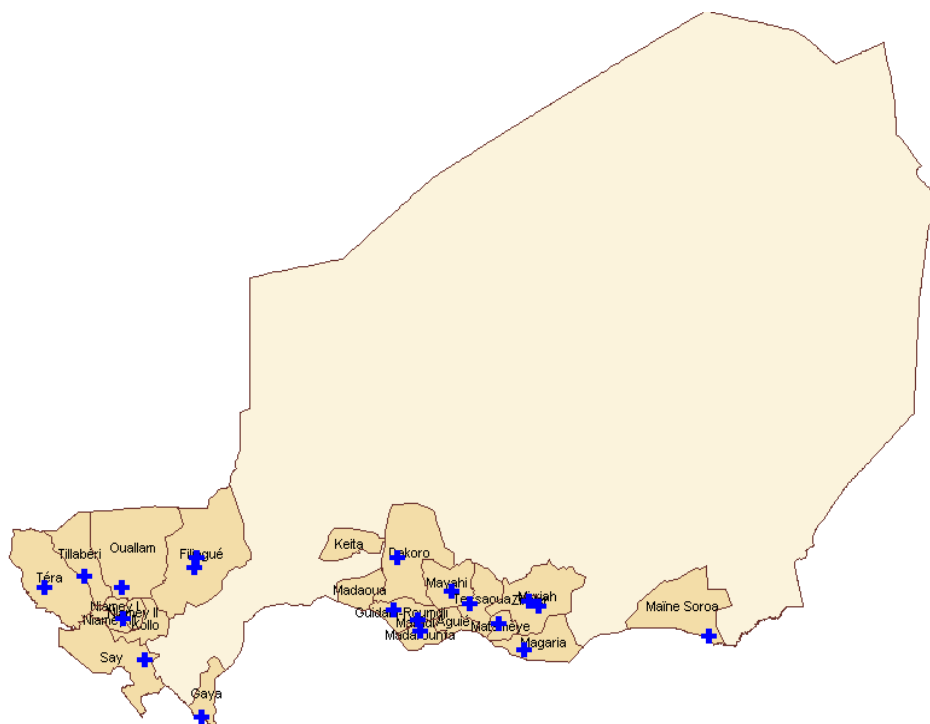


Figure 2. The areas selected for SMC 2016 in Niger

**Table 1: Repartition of HD in 2016 by partners**

REGIONS	HEALTH DISTRICTS	FOUNDERS
Maradi	Aguié, Dakoro, G Roudji, Madarounfa,	MSF
	Tessaoua, Mayahi, Maradi	ACCESS-SMC
Tahoua	Bouza, Tahoua Ville, Tahoua Département, Illela, konni, Madaoua et Keita	ACCESS-SMC
Zinder	Zinder, Matameye, Mirriah, Tanout	ACCESS-SMC
	Malaria, Gouré	MSF
Niamey	Niamey 1, Niamey 2, Niamey 3, Niamey 4, Niamey 5	Word Bank
Dosso	Gaya, Boboye, Loga, Dosso, Douchi	ACCESS-SMC
Tillabéry	Fillingue, Kollo, Oualam, Say, Tera, Tillabéry	Word Bank
Diffa	Maine Soroa, Diffa, Nguigmi	MSF

**Eligible children**

Of all HD included 2,707,742 children were eligible in 2016 (Table 2). The regions of Maradi (728,093) and Zinder (678060) respectively, had the high number of eligible children. The few number of eligible children (15722) was observed in Diffa.

**Table 2: Number of children eligible by regions in 2016**

	Diffa	Dosso	Maradi	Niamey	Tahoua	Tillabéry	Zinder	Niger
<b>Children 3-59 months</b>	15722	84068	728093	257937	290114	653748	678060	2707742
<b>Children under 5 years</b>	57461	84032	883405	186223	517671	628488	790849	3148129

**SMC delivery**

The number of eligible children by cycles of SMC and by regions was 1865275 for SMC1, 2703580 for SMC2, 2692472 for SMC3 and 2386997 SMC4 (Table 3) respectively.

**Table 3: Number of children eligible by regions by cycles in 2016**

	Diffa	Dosso	Maradi	Niamey	Tahoua	Tillabéry	Zinder	Total
<b>SMC1</b>	11514	84068	728093	0	260408	103132	678060	1865275
<b>SMC2</b>	17033	84068	710735	257937	285719	679531	668557	2703580
<b>SMC3</b>	15722	84068	710735	257938	260408	679530	684071	2692472
<b>SMC4</b>	15722	84068	710735	257938	260408	572398	485728	2386997

We showed a variation in the number of eligible children by cycles of SMC without the region of Dosso. Table 4 presented the number of tablets used by HD by cycle. The different values of the quantities of drugs by region were calculated in terms of drug boxes, ie  $B / 50$  for 3-11 months and  $B / 25$  for 12-59 months. The high drug used was observed in the first cycle of SMC1 in Tahoua (116549) and in the second cycle in Tillabéry (137130) respectively.

**Table 4: Quantity of drug used in SMC campaign 2016 by HD by cycle**

	Zinder	Maradi	Tahoua	Dosso	Diffa	Tillabéry	Niamey
<b>SMC1</b>	66505	61012	116549	5805	421	4052	0
<b>SMC2</b>	49631	45393	98143	7147	1403	137130	18147
<b>SMC3</b>	29295	65555	70468	4518	572	80481	12652
<b>SMC4</b>	29572	59773	39105	4518	497	76074	11688

**SMC coverage**

In 2016, the high coverage was observed in the cycle 2 of SMC (Fig 3). In the total of 39 HD targeted, there were 23 totally covered, including 4 partially covered and 12 that did not benefit from SMC. The national coverage rate in 2016 was 85.75%. This rate was calculated as the ratio of number of children who really received the full dose of SMC during each treatment cycle during each season of malaria transmission to the total number potentially eligible children for SMC. The region of, Tahoua, Zinder, Dosso and Diffa were partially coverage, with 85%, 99%, 75%, 73% and 73% respectively. The others regions were totally coverage with 84% in Maradi, 79% in Tillabéry and 59% in Niamey.

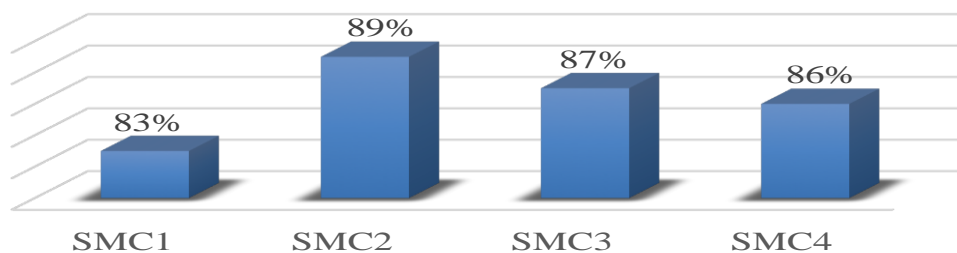


Figure 3 : SMC coverage in 2016 campaign in Niger

### Adverse effects (AEs)

During the four cycles of SMC delivery, 224 cases of non-serious adverse events (AEs) were notified by the national pharmacovigilance system. Before SMC fifth cycle started all the health workers and communities were sensitized on the AEs. The incidence was 0.82 per 10,000. The most AEs reported was digestive disorders such as nausea, vomiting, abdominal pain and diarrhoea. The other symptoms were fever, anorexia and pruritus.

The distribution by region showed that AEs were 41.78% in Dosso, 27.11% in Zinder, 23.11% in Maradi and 8% in Tahoua ( $P < 0.05$ ). No AEs were reported during the four cycles in Diffa, Tillabery and Niamey regions.

### Human resources

A total of 33,998 human resources were used in the implementation of SMC in all target regions in 2016 (Table 5). The higher number of human resources used in 2016 SMC implementation in Niger was observed in Zinder and Maradi. The region of Diffa and Dosso had the low number of human resources used in this 2016 SMC. In this campaign the high number of human resource used was distributor (8461) for the all region covered. For the communication activities, in a total of 11785 human resources were used, 4594 were public crier, 4503 leaders of the villages and 2688 religious leaders (Table 5).

Table 5: Details of human resources used in SMC implementation by region

	Diffa	Zinder	Maradi	Tahoua	Dosso	Niamey	Tillabéry
<b>Human resources</b>							
Administrative team	5	22	35	14	5	23	30
Health workers	38	607	126	219	22	438	235
Operational team	24	1006	936	313	106	549	1179
Distributors	29	2032	2243	844	289	439	2585
Community health workers	24	1186	1343	1187	168	568	1826
Supervisors	11	355	140	70	29	86	232
Trainers	9	117	131	44	24	63	207
Crieur public	7	1026	1087	312	106	439	1617
Leaders of villages	24	2451	821	312	106	60	729
Religious leaders	24	496	871	312	106	60	819
<b>Total</b>	<b>195</b>	<b>9298</b>	<b>7733</b>	<b>3627</b>	<b>961</b>	<b>2725</b>	<b>9459</b>

### Cost

In 2016, the total financial cost of the intervention was 1,027,336,229 CFA francs (US \$ 1 754 998.48) for scaling up in the 39 districts of the seven target regions of Niger. In Niger the cost of SMC administered by community health workers was estimated at US \$ 1.63 (969.85 FCFA) per child per year. The cost per children treatment in 2016 was 130.90 CFA francs (US \$ 0.22). The cost of 2016 SMC in Zinder, Diffa, Maradi, Tahoua, Dosso, Tillabéry and Niamey were 364,492,400 FCFA; 19,072,909 FCFA; 203,224,151 FCFA; 49,909,323 FCFA; 203,224,151 FCFA; 360,137,707 FCFA and 150,932,695 FCFA respectively. More than half had been used for operational costs (Figure 4). The cost of drug was 40,835,493 FCFA and the evaluation cost was 96,418,092 FCFA.

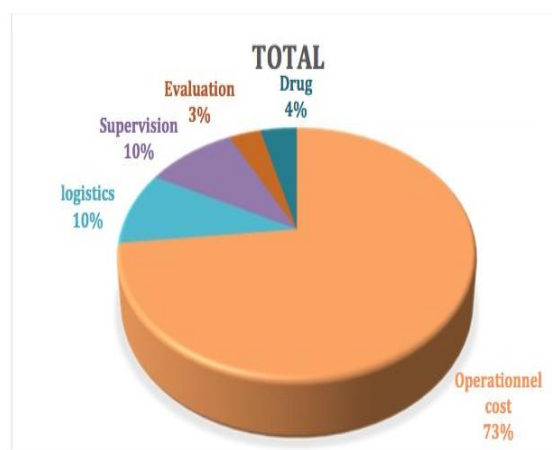


Figure 4: Financial cost profile by activity (%)

## DISCUSSION

The coverage rates achieved by the 39 districts in 2016 were 68.57%. This is a higher than what was obtained in 2015 large-scale implementation in Niger, which was 61.66%, this could be explained by the fact that SMC has covered more regions in 2016 than 2015. Some districts had coverage greater than 100%; this may be due to the participation of non-resident children in the CPS campaign and therefore increasing the coverage rate. Out of the total of 39 districts targeted, there were 27 health centres covered, including 4 partially covered districts and 12 districts that did not benefit from SMC. Coverage of SMC observed in this study were less than those shown in the SMC pilot studies in Niger and other large-scale implementation of SMC in sub-sahelian countries [10][5][4]. To uptake the levels of SMC coverage it will be important to improve effective communication or using door-to-door distribution and to do strong supervision [11].

In this study all AEs reported were non serious. These AEs observed in 2016 were higher than the data found in 2015 by Karima Sani Alio [12]. No severe AEs were observed in 2015. The gastrointestinal symptoms were the commonest minor AEs found according to the previous study in Niger [10]. It is possible that some AEs were not detected by pharmacovigilance system, because only four regions reported AEs. Similarly, this may be attributed to the quality of training ensured among healthcare workers in ensuring the delivery of services during the campaign including ensuring that only eligible children received the chemoprophylaxis. Non-serious and minimal number of AEs reported should be maintained but this may require substantial investment in training, coordination and logistics [13].

In 2016, the total financial cost of the intervention was 1,027,336,229 CFA francs (US \$ 1 754 998.48) for scaling up in the 39 districts of the seven target regions of Niger. The cost per children treatment in 2016 was estimated at 130.90 CFA francs (US \$ 0.22). Expenditures were dominated by operational cost with 73% of total cost. This cost was significantly higher than that found (56%) by Isaac Manga A. (2015) in Senegal in a study describing the 2013-2014 SMC campaign [14]. In addition, the evaluation of the costs of SMC from large-scale trials shows that the largest costs result from the drug administration and the payment of health workers. In Niger the cost of SMC administered by village health workers was estimated at US \$ 1.63 per child per year. In Senegal, where community health workers administered SMC, paid on a per diem basis and supervised by a health post nurse, the average cost for 46 health posts has been estimated at US \$ 0.50 per child per day and months, or approximately US \$ 1.50 per child per year [4]. This review is limitedly lack of confirmation of SMC status of all children included in the study, the data of AEs were provide by four regions out of seven and other limitations associated with the use of administrative data. Also we are not able to interpret the impact of this coverage on the incidence of malaria but may serve as a foundation for future researches,

however, the findings might be useful for monitoring SMC scaling up in Niger.

## CONCLUSION

High coverage was observed in all cycles. SMC is economically beneficial in reducing morbidity and mortality among children under-5 years. SMC with sulfadoxine-pyrimethamine and amodiaquine was well tolerated by children during the 2016 campaign.

In Niger, SMC is included in the NMCP Policy for malaria control since May 2013 and SMC implementation, guidelines and manuals have been developed, training conducted and drugs made readily available for distribution.

## CONFLICT OF INTERESTS

The authors declared that they have no competing interests.

## AUTHORS' CONTRIBUTIONS

Aminata Souley and Lamine Mahaman Moustapha analyzed the data and drafted the manuscript.

Mahamadou Douchi, Abdoulaye Diallo, Ibrahim Ouba, Rahila Abdoulaye, Jean Louis NDiaye and Maman Laminou Ibrahim conceived and designed the study.

All authors read and approved the final manuscript.

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