



## FACTORS ASSOCIATED WITH INTERMITTENT PREVENTIVE TREATMENT OF MALARIA DURING PREGNANCY IN MALI

Souleymane S. Diarra<sup>1</sup>, Drissa Konaté<sup>1</sup>, Sory I. Diawara<sup>1</sup>, Mariam Tall<sup>2</sup>, Mahamadou Diakité<sup>1</sup>, and Seydou Doumbia<sup>1</sup>

<sup>1</sup> International Center for Excellence in Research, University of Sciences Techniques and Technology of Bamako, Point-G, Mali BP 1805.

<sup>2</sup> National Program of Malaria Control, Mali, BP: 233, Badalabougou SEMA Bamako. Correspondence should be sent to Souleymane S. Diarra at: [diarrasoul24@yahoo.fr](mailto:diarrasoul24@yahoo.fr)

### KEY WORDS ABSTRACT

Malaria  
Pregnancy  
ANC  
IPTp-SP

Intermittent preventive treatment in pregnancy (IPTp) with 3 or more doses of sulfadoxine-pyrimethamine (SP) is recommended by the World Health Organization to prevent malaria in pregnant women living in high-risk areas. According to the 2015 malaria indicator survey in Mali, malaria prevalence is 34.6%. The high risk of malaria among pregnant women and children led the Malian government to provide free SP during antenatal clinics visits. The Malian National Program of Malaria Control recommends at least 3 doses during pregnancy. The proportion of pregnant women taking 3 or more doses of IPTp-SP (IPTp 3+) still remains low. In Mali, only 36.7% of pregnant women with a live birth in the past 2 yr received IPTp 3+. To investigate the factors associated with this low coverage, we carried out a secondary data analysis using the database of the Mali 2015 Malaria Indicator Survey. Multiple logistic regression was used to analyze these factors among 2,382 interviewed women. Taking less than 3 doses was higher among women below 20 yr (adjusted odds ratio [AOR] = 1.43, 95% confidence interval [CI, 1.03; 1.98]); however, media accessibility (listening to radio) (AOR = 0.71, 95% CI [0.53–0.95]) and residing in Segou (AOR = 0.56, 95% CI [0.35–0.90]) seem to favor the opposite after adjusting the potential confusion. Residence, educational level, and wealth index were not statistically associated with taking 3 doses of IPTp-SP. This study identifies that women less than 20 yr of age were significantly associated with taking lower than 3 doses of IPTp-SP.

Malaria infection during pregnancy is a major public health problem with substantial risks for pregnant women, fetuses, and newborns in Africa in general and sub-Saharan Africa in particular (World Health Organization (WHO), 2017)). Malaria severity among pregnant women varies depending on malaria transmission intensity and level of acquired immunity in the geographical area. Maternal anemia and low birth weight are documented as important devastating health consequences of *Plasmodium falciparum* (Kayentao et al., 2007; Exavery et al., 2014).

In Mali, malaria is the primary reason for outpatient visits in the health centers according to the national Demographic and Health Survey (DHS), (Cellule de Plantification et de Statistique, 2014). Malaria affects mostly pregnant women, but symptoms and complications among pregnant women vary by geographical transmission areas in Mali (Kayentao et al., 2007; Famanta et al., 2011). The National Malaria Control in Mali and the WHO recommended giving intermittent preventive treatment in pregnancy (IPTp) with at least 3 doses of sulfadoxine-pyrimethamine (SP) to prevent malaria during pregnancy across the country (Malaria Indicator Survey (MIS), 2015)). The proportion of

women taking 3 or more doses of IPTp-SP (IPTp 3+) to prevent malaria during pregnancy still remains low in Mali. According to the Malian 2015 MIS, only 37% of pregnant women received IPTp 3+ (MIS, 2015). In this study, we aimed to investigate factors associated with taking IPTp 3+ or less than 3 doses of IPTp-SP in Mali. We anticipate that our results will help to identify factors associated with IPTp-SP in Mali and will allow the decision makers to find appropriate solutions to improve the Malaria prevention coverage rate.

### MATERIALS AND METHODS

In recent years, the renewed focus on eliminating malaria worldwide has been accompanied by a rapid increase in the measurement of key malaria indicators through nationally representative household surveys. These MIS measure indicators related to the Roll Back Malaria Global Malaria Action Plan, the Millennium Development Goals, and the President's Malaria Initiative targets. Information is collected on the ownership and use of insecticide-treated mosquito nets, indoor residual spraying of insecticides, prompt and effective treatment of fever in young



**Table I.** Proportion of women taking sulfadoxine-pyrimethamine (SP) during pregnancy.

Taking SP during pregnancy?	n	%
No	800	33.6
Yes	1,582	66.4
Total	2,382	100.0

children, and the prevention of malaria in pregnant women. Most MIS surveys also include biomarker tests for anemia and malaria.

We carried out a secondary data analysis using the database of the Mali MIS 2015. The Mali MIS 2015 provides information on the knowledge and practice of malaria prevention in Mali. The sampling frame used for the 2015 Mali MIS was the part of phase 7 of the DHS series. As in the 2012–2013 DHS-V, the 5 southern regions (Kayes, Koulikoro, Sikasso, Ségou, and Mopti), as well as the urban and rural areas, Bamako district, and all the other cities have the 9 operational areas of study for this survey. The sample size was calculated to provide statistically representative results on the prevalence of malaria among children aged 6–59 mo and on all malaria indicators for each of the 9 domains of study previously defined. It should be noted that in the 2012–2013 DHS-V, 3 circles (Dountza, Youwarou, and Tenenkou) from the Mopti region were excluded from the survey for security reasons, unlike the 2015 MIS in which the collection covered the entire region. The survey used a 2-stage stratified cluster sampling design. We used appropriate sampling weights in the logistic model. The Stata statistical package “STATA 14.0” was used to perform our data analysis (StataCorp, 2015). In the first stage, 180 clusters were selected proportionately to their size. For safety reasons, only 177 clusters out of 180 selected were finally covered. A list of Enumeration Zones was established in the 2009 General Population and Housing Census (Direction Nationale de la Statistique et de l’Informatique, 2009). From the list of households established during this enumeration operation, 4,251 households were drawn at the second level, with equal probability. Of these 4,251 households selected, 4,243 were identified. Of these households, 4,240 were successfully interviewed, resulting in a 99.9% response rate. There was no significant difference between rural and urban areas. In these 4,240 households successfully interviewed, 7,824 women aged 15–49 were identified as eligible for the individual survey, of whom 7,758 were successfully interviewed. The response rate of the individual survey is 99.2%.

Two questionnaires were used during the 2015 Mali MIS, a household questionnaire and an individual questionnaire for women aged 15–49. The Women’s Questionnaire was used to collect information from women age 15–49 on background characteristics, reproductive history for the last 6 yr, antenatal care and preventive malaria treatment for the most recent birth, fever prevalence and treatment among children under age 5, and knowledge and attitudes regarding malaria treatment and prevention.

Intermittent Preventive Treatment: this section addressed only women who had a birth in the last 2 yr. They were asked whether they had received antenatal care and whether they had received preventive treatment for malaria during pregnancy; and if so, were asked how many doses were received during pregnancy and, for each dose received, the number of SP/Fansidar tablets taken if

**Table II.** Proportion of women taking 3 doses of sulfadoxine-pyrimethamine against malaria as intermittent preventive treatment in pregnancy (IPTp).

IPTp doses received during pregnancy	n	%
3 doses or more	580	36.7
Under 2 doses	1,002	63.3
Total	1,582	100.0

taken during antenatal care and if they were taken in the presence of health personnel. The data collection took a period of 3 mo, from 19 September to 20 November 2015.

The wealth index was based on the data from the household’s ownership of consumer goods, dwelling characteristics, source of drinking water, type of toilet facilities, and other characteristics that relate to a household’s socio-economic status. To construct the index, each of these assets was assigned a weight (factor score) generated through principal component analysis, and the resulting asset scores were standardized in relation to a standard normal distribution, with a mean of zero and a standard deviation of one. Each household was then assigned a score for each asset and the scores were summed for each household. Individuals were ranked according to the total score of the household in which they resided. The sample was then divided into quintiles from 1 (lowest) to 5 (highest). We selected from the database all women with a last live birth and who had used SP to prevent malaria.

The National Program of Malaria Control (NPMC) decided to give free SP during antenatal clinic (ANC) visits. We classified IPTp-SP in 2 categories for our analysis (code “0”: took less than 3 doses of IPTp-SP and code “1”: took 3 or more doses of IPTp-SP during pregnancy). Independent variables included residence (rural or urban), region, educational level, age, wealth index, and information source (radio). Dependent variables included taking 3 or more doses of IPTp-SP or less than 3 doses. We first proceeded to put all the independent variables in the model. Then we excluded some of them based on their change-to-estimates. We used a chi-square test to look for associations between categorical variables and multiple regression analysis to determine factors associated with taking less 3 doses, or IPTp 3+, of SP during pregnancy among 2,382 interviewed women. The threshold of statistical significance was fixed at 0.05.

## RESULTS

During their last pregnancy, 66.4% (1,582/2,382) of women reported taking IPTp-SP (Table I). Among them, only 36.7% (580/1,582) self-reported the ingestion of IPTp 3+ during antenatal visits (Table II).

The majority (70.6%) of pregnant women resided in rural areas. The region of Segou was the most represented with 20.6% and Mopti’s region was the least represented with 9.6%. Pregnant women were primarily 20–34 yr old (56.0%) with 26.7% less than 20 yr old and 17.3% 35 yr or older. The women were uneducated in 67.5% of cases. They had a high wealth index (47.7%) more often than a low wealth index (32.6%). The interviewed women listened to the radio as their source of information in 78.7% of cases (Table III).

Using multiple logistic regression, taking less than 3 doses of IPTp-SP during antenatal visits was associated with women age

**Table III.** Summary of epidemiological characteristics of women included in the study.

Variables	n	%
Place of residence		
Urban	466	29.4
Rural	1,116	70.6
Region		
Kayes	225	14.2
Koulikoro	303	19.2
Sikasso	286	18.1
Segou	326	20.6
Mopti	152	9.6
Bamako	290	18.3
Age category		
20–34 yr	882	56.0
Under 20 yr	420	26.7
35 yr or more	273	17.3
Educational level		
Without education	1,069	67.5
Primary	241	15.3
Secondary and high	272	17.2
Wealth index		
Poor	516	32.6
Middle	311	19.7
Rich	755	47.7
Source of information: radio		
No	338	21.3
Yes	1,244	78.7

under 20 yr (adjusted odds ratio [AOR] = 1.43; 95% confidence interval [CI, 1.03–1.98]), after adjustment of potential confounding factors, including radio, as source information for households residing in the region of Segou as well as residence (rural or urban), educational level, and wealth index (Table IV).

## DISCUSSION

According to the WHO recommendations, the NPMC in Mali decided to provide IPTp 3+ to prevent malaria among pregnant women during antenatal visits (WHO, 2014). This study aimed to analyze factors associated with taken IPTp 3+ during pregnancy from the Malian 2015 MIS database.

Database analysis showed that 66.4% of women self-reported taking sulfadoxine-pyrimethamine (SP) during their last pregnancy (Table I), which was an improvement as compared to the 35% coverage rate in the 2014 DHS. The coverage rate of 72.1% was reported in Tanzania (Exavery et al., 2014), and 64.4% of pregnant women receiving at least 2 doses of IPTp-SP in Ghana were reported (Stephen et al., 2015). Prevalence reported by a demographic health survey concerning a last pregnancy was opposite to our study. We were interested determining if IPTp-SP taken during a last pregnancy with live birth could explain the high prevalence in our study. Among women self-reporting taking IPTp-SP during their last pregnancy, only 36.7% received IPTp 3+ during antenatal visits (Table II).

We have found that women aged less than 20 yr old were significantly associated with lower IPTp 3+ observance (AOR =

**Table IV.** Relationship between epidemiological factors and intermittent preventive treatment in pregnancy with 3 or more doses of sulfadoxine-pyrimethamine.

Variables	Odds ratio	Confidence interval 95%	P
Place of residence			
Urban	1	(base)	
Rural	1.22	0.76–1.96	0.40
Region			
Kayes	1	(base)	
Koulikoro	0.71	0.45–1.11	0.13
Sikasso	0.80	0.89–1.31	0.38
Segou	0.56	0.35–0.90	0.02
Mopti	0.87	0.52–1.46	0.59
Bamako	0.80	0.46–1.39	0.43
Age category			
20–34 yr	1	(base)	
Under 20 yr	1.43	1.03–1.98	0.03
35 yr or more	1.12	0.83–1.53	0.45
Educational level			
Without education	1	(base)	
Primary	1.03	0.71–1.47	0.89
Secondary and high	0.99	0.69–1.43	0.99
Wealth index			
Poor	1	(base)	
Middle	1.07	0.79–1.43	0.67
Rich	1.18	0.81–1.70	0.38
Source of information: radio			
No	1	(base)	
Yes	0.71	0.53–0.95	0.02

1.43; 95% CI [1.03–1.98]). At this age, young pregnant women are more inclined not to go to health centers for antenatal visits, especially if they are single and have a lack of financial support with which to seek care. Exavery found no association between an age less than 20 yr old and taking IPTp 3+ during pregnancy (Exavery et al., 2014). However, we observed that media accessibility (listening to radio) (AOR = 0.71; 95% CI [0.53–0.95]) and residing in Segou (AOR = 0.56; 95% CI [0.35–0.90]) seemed to favor the opposite and be in favor of taking IPTp 3+ after adjusting the potential confusion (Table IV). Similar observations according to districts of residence were reported in Tanzania (Exavery, 2014). Most households had a radio to listen to at home or in the workplace for information. The large majority of information is transmitted in a local language. These facilitate awareness and encourage the population, especially pregnant women, to go to health centers for ANC visits. We did not find an explanation for the association between residing in the region of Segou and taking of IPTp 3+, but among women who self-reported receiving SP during prenatal consultations, the region of Segou was the most represented with 20.6%.

We found no statistical association between the level of education, wealth index, urban or rural residence, and taking of 3 doses of IPTp after adjusting for other confounding factors. Given the availability of information in the local language, the absence of barrier between the poor and wealthy people in the society, and free intermittent preventive treatment with SP, could explain the lack of association between taking 3 doses of SP and

these factors. An association between level of education and taking IPTp-SP during pregnancy was reported in another study as factors affecting uptake of optimal doses of IPTp-SP during pregnancy (Exavery, 2014) and taking 2 doses of IPTp-SP during pregnancy (Mwandama et al., 2015).

Our findings show that the NPMC and Ministry of Health should emphasize awareness through the early pregnancy in women. These results show that additional studies are needed to better understand the factors associated with taking of IPTp-SP. A better understanding of these factors will enable development of strategies for increasing the use of IPTp-SP at the WHO-recommended 3 or more doses.

For safety reasons, only 177 clusters out of 180 selected were finally covered in the Mali 2015 MIS. Our data do not allow us to analyze cultural barriers. Also, our analysis does not take into account the physical accessibility of women to health structures for ANC visits. These are some of the challenges and limitations of this study.

### CONCLUSION

Our study identifies that media accessibility and women residing in the region of Segou were factors associated with higher IPTp 3+ usage. However, the age of women less than 20 yr old was associated with lower IPTp 3+ uptake. Additional socio-anthropological studies at the village level will be important to better understand the factors associated with taking IPTp 3+ in Mali.

### ACKNOWLEDGMENTS

We would like to thank Measure Evaluation/USAID for supporting this work. We are grateful to Professor Lia Florey, Malaria Epidemiologist/Technical Specialist, Demographic and Health Surveys (DHS) Program for her facilitation efforts. We would also like to thank the Fogarty International Center for supporting S. S. Diarra and D. Konaté under Grant D43TW008652.

### LITERATURE CITED

- Cellule de Planification et de Statistique - CPS / SSDSPF / Mali, Institut National de la Statistique - INSTAT / Mali, Centre d'Études et d'Information Statistiques - INFO-STAT / Mali et ICF International, 2014. Enquête Démographique et Santé au Mali 2012-2013. Rockville, Maryland, États-Unis: CPS, INSTAT, INFO-STAT et ICF International. Available at: <https://dhsprogram.com/publications/publication-FR286-DHS-Final-Reports.cfm>. Accessed 4 March 2019.
- EXAVERY, A., G. MBARUKU, S. MBUYITA, M. MAKEMBA, I. P. KINYONGE, AND H. KWEKA. 2014. Factors affecting uptake of optimal doses of sulphadoxine-pyrimethamine for intermittent preventive treatment of malaria in pregnancy in six districts of Tanzania. *Malaria Journal* 13: 22. doi:10.1186/1475-2875-13-22.
- FAMANTA, A., M. DIAKITE, S. I. DIAWARA, S. DOUMBIA, K. TRAORÉ, D. S. KONATÉ, M. DOUMBIA, A. S. KEITA, D. THIÉRO, S. F. TRAORÉ, ET AL. 2011. Prevalence of maternal and placental malaria and of neonatal low birth weight in a semi-urban area of Bamako (Mali). *Sante* 21: 3–7.
- KAYENTAO, K., M. MUNGAI, M. PARISE, M. KODIO, A. S. KEITA, D. COULIBALY, B. MAIGA, B. TRAORÉ, AND O. K. DOUMBO. 2007. Assessing malaria burden during pregnancy in Mali. *Acta Tropica* 102: 106–112.
- MIS (MALARIA INDICATOR SURVEY). 2015. Enquête sur les Indicateurs du Paludisme (EIPM) 2015: Prise de SP/fansidar au cours de la grossesse et Traitement Préventif Intermittent (TPIg). Available at: <http://www.dhsprogram.com/pubs/pdf/MIS24/MIS24.pdf>. Accessed 17 August 2017.
- MWANDAMA, D., G. GUTMAN, A. WOLKON, M. LUKA, J. JAFALI, D. ALI, D. P. MATHANGA, AND J. SKARBINSKI. 2015. The use of intermittent preventive treatment in pregnancy and insecticide-treated bed nets for malaria prevention by women of child-bearing age in eight districts in Malawi. *Malaria Journal* 14: 316. doi:10.1186/s12936-015-0840-y.
- STATA CORP. 2015. Stata statistical software, release 14. StataCorp LP, College Station, Texas.
- STEPHEN, A. S., F. WURAPA, E. A. AFARI, S. O. SACKEY, K. L. MAL, AND K. M. NYARKO. 2015. Factors influencing utilization of intermittent preventive treatment for pregnancy in the Gushegu District, Ghana, 2013. *Pan African Medical Journal* 25(Suppl. 1): 4. doi:10.11604/pamj.supp.2016.25.1.6169
- WHO (WORLD HEALTH ORGANIZATION). 2014. Policy brief for the implementation of intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP), April 2013. Available at: [http://www.who.int/malaria/publications/atoz/policy\\_brief\\_iptp\\_sp\\_policy\\_recommendation/en/](http://www.who.int/malaria/publications/atoz/policy_brief_iptp_sp_policy_recommendation/en/). Accessed 17 August 2017.
- WHO. 2017. Malaria in pregnant women. Available at: [http://www.who.int/malaria/areas/high\\_risk\\_groups/pregnancy/en/](http://www.who.int/malaria/areas/high_risk_groups/pregnancy/en/). Accessed 17 August 2017.