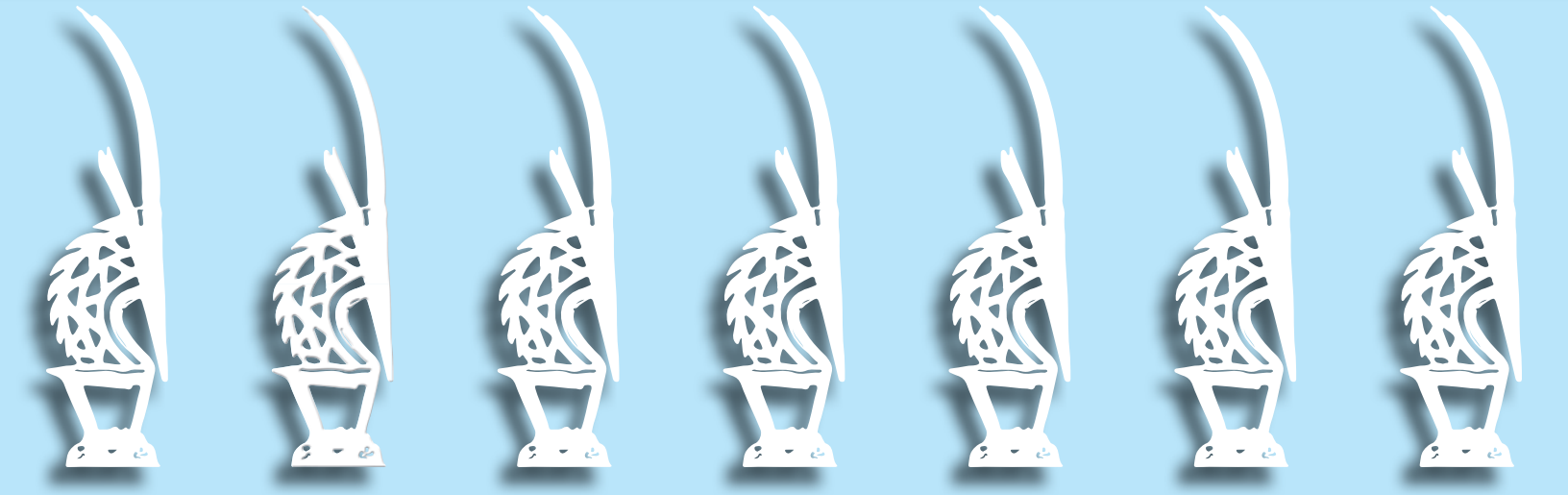
Trends in and Factors Associated with Malaria Prevention in Mali

Further Analysis of the Mali Demographic and Health Surveys and Malaria Indicator Surveys 2006-2018



DHS Further Analysis Reports No. 132

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Further Analysis of the Mali Demographic and Health Surveys and Malaria Indicator Surveys 2006-2018

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ABSTRACT

This study uses data from Demographic and Health Surveys (DHS) and Malaria Indicator Surveys (MIS) conducted in Mali from 2006 to 2018 to assess regional trends in two key areas of malaria prevention: the provision and use of insecticide-treated nets (ITNs), and protection against malaria in pregnancy. Trends during the study period reflect the increased investment in these two areas. While comparison of national trends is limited by the exclusion of the northern regions in 2012-13 and 2015, and the security concerns that affected sampling in Kidal in 2006, 2010, and 2018, the regional trends between surveys support an overall positive and significant improvement in the coverage of ITNs and intermittent preventive treatment in pregnancy (IPTp) throughout the country.

Trend analysis shows positive changes between the 2006 and 2018 surveys in ITN indicators, in response to ITN distribution through mass campaigns, routine antenatal care (ANC) and childhood immunizations, and sales of ITNs at shops and markets. The use of ITN by pregnant women and children under age 5 has consistently been at least 70% since 2010, and population ITN use is nearly equal to population access to an ITN, which reflects a strong culture of ITN use. Although the percentage of women who received at least three doses of sulfadoxine-pyrimethamine (SP)/Fansidar (IPTp3) coverage has significantly increased since 2006, and has continued to increase with each survey, overall rates of IPTp3 remain below 30%, with significant gains from 2015 to 2018 limited to the Bamako and Koulikoro regions. In 2018, fewer than half of women who made at least four ANC visits received at least three doses of sulfadoxine-pyrimethamine (SP). This reflects significant missed opportunities to provide IPTp. However, since 2012-13, nationwide gains in IPTp3 appear to be due primarily to an increase in IPTp provision, rather than increased ANC attendance. The rates of ANC4 have not changed significantly since 2012-13 in any region. This suggests that the increased investments in provider in-service training, refresher training, and supply chain management for SP are likely responsible for the progress in IPTp3 rates.

There are clear disparities in ITN and IPTp coverage between the central/southern and the northern regions. Since 2012, insecurity in the northern areas has impeded implementation of malaria prevention activities. In 2018, Tombouctou and Gao lagged behind the other regions in all coverage indicators, although net use indicators were as strong as in the rest of the country.

Key words: malaria, ITNs, IPTp, malaria in pregnancy, vector control

ABBREVIATIONS

ANC	antenatal care
AP	anemia and parasitemia survey
DHS	Demographic and Health Survey
DOT	directly observed therapy
EPI	Expanded Programme on Immunizations
IPT1	Percentage of women who received at least one dose of SP/Fansidar during their most recent pregnancy
IPT2	Percentage of women who received at least two doses of SP/Fansidar during their most recent pregnancy
IPT3	Percentage of women who received at least three doses of SP/Fansidar during their most recent pregnancy
IPTp	intermittent preventive treatment in pregnancy
ITN	insecticide-treated nets
LLIN	long-lasting insecticidal nets
MIS	Malaria Indicator Study
NMCP	National Malaria Control Program
RDT	rapid diagnostic test
SP	sulfadoxine-pyrimethamine

1 INTRODUCTION

1.1 Background

Malaria is the primary cause of morbidity and mortality in Mali, across all ages and particularly among children under age 5. In 2018, Mali recorded 2,614,104 confirmed malaria cases, which represent 39% of all health service consultations across all age groups (INSTAT, CPS, and ICF 2019). In addition to the health burdens of the disease, malaria has a negative impact on Mali's economy by reducing the gross domestic product and impeding children's education and social development. Since children under age 5 and pregnant women are most affected, malaria is a priority focus in national health policy.

Malaria transmission in Mali is endemic in the central and southern regions, which comprise 90% of Mali's population, and epidemic-prone in the north, where the desert climate is less favorable for *Anopheles* species reproduction, and in certain parts of Koulikoro and Kayes regions (Nara, Nioro, Diéma, Yélimané, Kayes). Results from the 2018 Demographic and Health Survey (DHS) indicate that 19% of children age 6-59 months were infected with malaria at the time of interview, according to rapid diagnostic testing (RDT) (INSTAT, CPS, and ICF 2019).

Mali's 2018-2022 strategic plan to fight malaria established three objectives to: 1) reduce malaria mortality by 50% of 2015 levels; 2) reduce malaria incidence by 50% of 2015 levels; and 3) strengthen capacities in the coordination and management of the National Malaria Control Program (NMCP) at all levels. The national malaria control strategy focuses on five major interventions for preventing and treating malaria: 1) accurate diagnosis and appropriate treatment, 2) sleeping under insecticide-treated mosquito nets (ITNs), 3) intermittent preventive treatment for pregnant women (IPTp), 4) indoor residual spraying in targeted areas, and 5) seasonal malaria chemoprophylaxis for children under age 5.

In November 2018, Mali joined the "High Burden to High Impact" country-led approach (WHO 2018), as one of the 11 highest burden countries that account for 70% of the estimated global burden and 71% of estimated deaths from malaria. While deaths have been reduced since 2013, progress has stalled and estimated cases remain over 6 million per year, according to the 2019 World Malaria Report (WHO 2019). Mali represents 3% of the global burden of malaria, and has joined Burkina Faso, Cameroun, Ghana, Mozambique, Niger, Nigeria, Uganda, Democratic Republic of Congo, Tanzania, and India in the effort to reach the goals of the Global Technical Strategy by 2020.

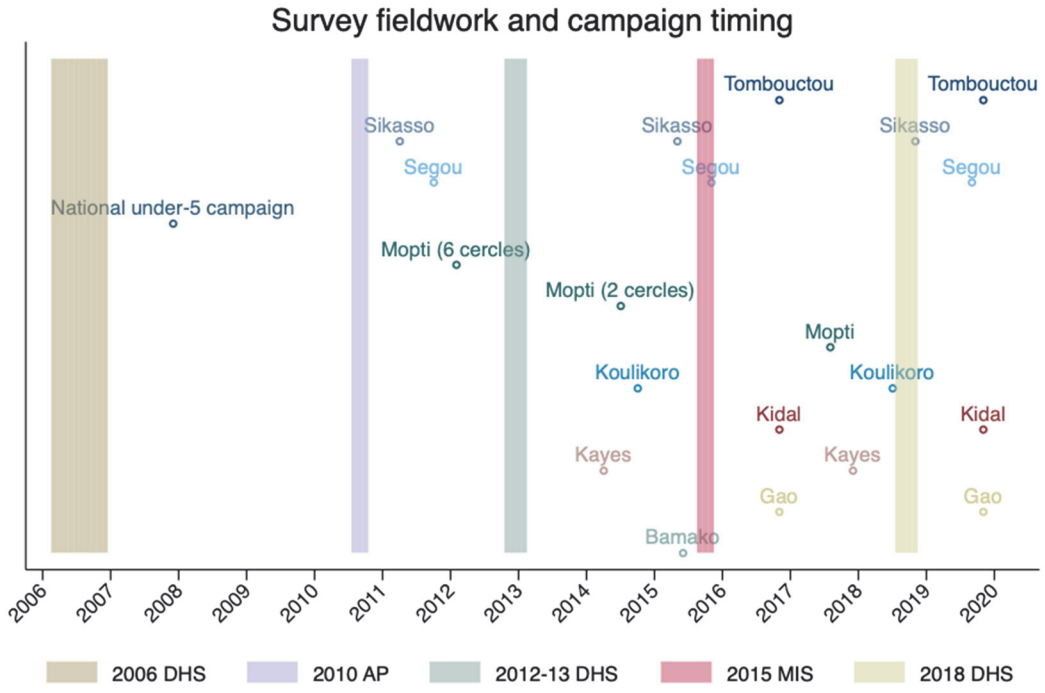
1.2 Context of National Malaria Control

1.2.1 ITNs

The NMCP provides free nets through mass distribution campaigns to all households, and pregnant women and infants who complete vaccination at antenatal care (ANC) visits and Expanded Programme on Immunization (EPI) visits (Initiative USPM 2018). In 2007, Mali implemented an integrated campaign to provide children under age 5 with vaccinations against measles and polio, Vitamin A, albendazole, and ITNs.

Since 2011, Mali has been conducting mass campaigns that aim to distribute 1 ITN for every two people in order to achieve universal coverage. These campaigns occur on a rolling basis by region, and generally every 3 years. However, some regions have experienced longer intervals—on average 4 years in the southern-central regions—between campaigns. The ITN coverage begins to decline immediately after campaigns, due to wear and tear on nets, and accelerates in the second year post-campaign. **Figure 1** indicates the timing of recent mass campaigns and the surveys described in this report.

Figure 1 Timing of survey fieldwork and regional mass ITN campaigns



Note: Sikasso 2018 distribution occurred after completion of MIS fieldwork in that region.

1.2.2 IPTp

The NMCP collaborates with the Reproductive Health Division, Midwives Association, and donor agencies to implement in-service training and supervision of health providers for ANC services. The training, which is based on current IPTp recommendations, has been expanded in recent years to include training all new providers, and providing refresher training every 2 years for existing providers (Initiative USPM 2018). The SP stock availability has also improved. Mali has not reported a SP stockout at the facility level greater than 12.9% (2016-2018) since stockouts have been between 6-8% or less (Initiative USPM 2018).

1.3 Objective of the Report

Malaria prevalence among children under age 5 has been decreasing since 2012-13, as shown in the 2012-2013 and 2018 DHS surveys and the Malaria Indicator Study (MIS) 2010 and 2015 surveys. The objective of this analysis is to examine trends in the coverage of (ITNs) and the IPTp since 2006, and to investigate geographic disparities in coverage.

2 DATA AND METHODS

2.1 Data

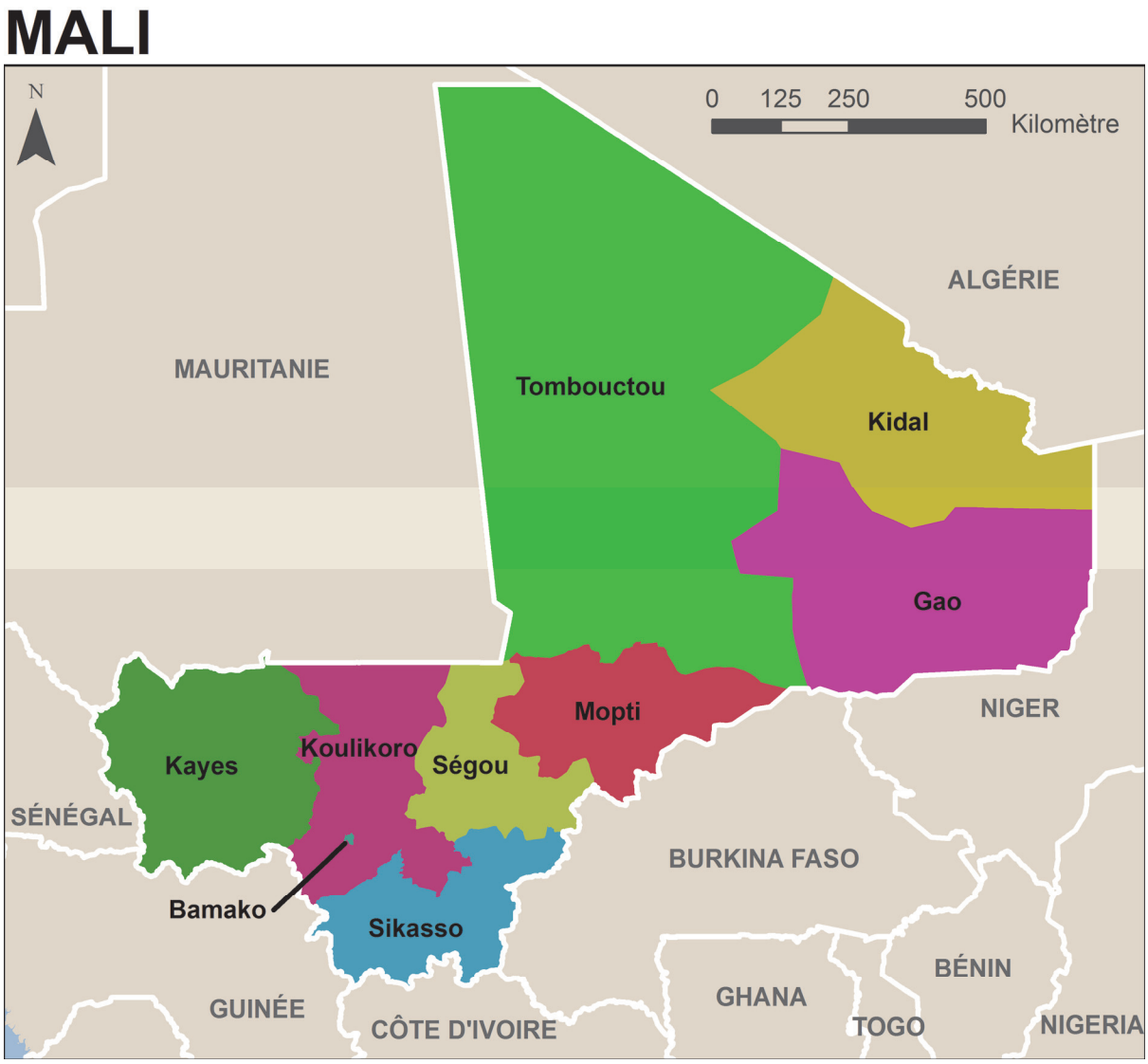
This analysis uses data from the Mali 2006, 2012-13, and 2018 DHS, the 2010 Anemia and Parasitemia Survey (AP), and the 2015 MIS. **Table 1** summarizes the sample size for each survey and identifies areas excluded from surveys due to insecurity. A map of Mali's five regions is shown in **Figure 2**.

Table 1 Sample sizes and notes for 2006-2018 Demographic and Health Surveys and Malaria Indicator Surveys

Survey	Number of households interviewed	Number of eligible women age 15-49 interviewed	Sampled regions	Notes
2006	12,998	14,583	all	3 clusters of Kidal excluded
2010	1,617	n/a	all	1 cluster of Kidal excluded
2012-13	10,105	10,424	Gao, Tombouctou, Kidal excluded	3 cercles of Mopti excluded
2015	4,240	7,758	Gao, Tombouctou, Kidal excluded	
2018	9,510	10,519	all	Kidal sampled only urban clusters

The 2006 DHS included all regions of Mali (CPS, DNSI, and Macro International 2008), but due to insecurity, the 2012-13 DHS excluded the three northern regions of Gao, Kidal, and Timbuktu, as well as three cercles within Mopti (CPS, INSTAT, INFO-STAT, and ICF International 2014). The 2015 MIS also excluded Gao, Kidal, and Timbuktu (INSTAT, INFO-STAT, and ICF International 2015). One option when regions are inconsistent between surveys is to omit the excluded regions from all comparative analyses, as in the 2014 further analysis by Westoff et al. (2014). One disadvantage of omitting regions from analyses is that the total estimates for each survey are not consistent with StatCompiler (http://www.statcompiler.com/). The further analysis by Castle and Scott in 2014 chose not to omit regions for this reason and to avoid discarding data. This analysis will use the same approach. Readers must keep in mind that the estimates of differences between surveys are potentially biased and may not reflect what would have been found if all surveys had included all regions. This potential bias is noted throughout this report.

Figure 2 Map of Mali



2.2 Methods

2.2.1 Indicators

Table 2 describes the malaria indicators examined in this study, including the population we used to calculate each indicator, the weighted sample size, and the definition of the indicator. The indicators are examined across the following characteristics: education of household head (for ITN indicators) or woman's education for IPTp indicators (none, primary, secondary or higher), place of residence (urban, rural), household wealth quintile (lowest, second, middle, fourth, highest), and region (Kayes, Koulikoro, Segou, Sikasso, Mopti, Gao, Tombouctou, Kidal, and Bamako).

National and regional trends in the indicators are presented graphically in figures throughout this report. All indicators are graphed by the year fieldwork was conducted—2006 DHS, 2010 AP, 2012-13 DHS (graphed as 2012), 2015 MIS, or 2018 DHS.

Table 2 Malaria prevention indicators included in the study

			Sample Size				
Indicator	Definition	Population base	2006 DHS	2010 AP	2012-13 DHS	2015 MIS	2018 DHS
Plasmodium falciparum prevalence in children age 6-59 months	Percentage of children age 6-59 months with a positive malaria RDT	Children age 6-59 months	n/a	1,755	4,685	7,282	4,333
Anemia prevalence in children age 6-59 months	Percentage of children age 6-59 months with hemoglobin <8g/dl	Children age 6-59 months	n/a	1,755	4,685	7,282	4,333
Household ITN ownership	Percentage of households that own at least 1 ITN	Interviewed households	12,998	1,617	10,105	4,240	9,510
Household ownership of at least 1 ITN for 2 people	Percentage of households that own at least 1 ITN for 2 people	Interviewed households	12,998	1,617	10,105	4,240	9,510
Population access to ITN	Percentage of the population that have access to an ITN within their household, assuming each ITN protects two people	Total number of individuals who slept in interviewed households the night before the survey	70,871	9,561	55,658	38,705	53,477
Population use of ITNs	Percentage of the population who used an ITN the night before the survey	Total number of individuals who slept in interviewed households the night before the survey	70,871	9,561	55,658	38,705	53,477
ITN use: access ratio	Ratio of ITN use to population ITN access	Total number of individuals who slept in interviewed households the night before the survey	70,871	9,561	55,658	38,705	53,477
Proportion of existing nets used the previous night	Percentage of nets that were used the night before the survey	Nets recorded in households with a yes or no answer for whether it was used the previous night	16,474	3,841	21,997	13,942	23,426
ITN use by children under age 5	Percentage of children under age 5 who used an ITN the night before the survey	Children under age 5 who slept in interviewed households the night before the survey	13,061	2,032	10,539	8,051	9,799
ITN use by pregnant women	Percentage of currently pregnant women who used an ITN the night before the survey	Currently pregnant women who slept in interviewed households the night before the survey	1,799	n/a	1,165	791	1,154
ANC attendance	Percentage of women with one or more ANC visits for their most recent pregnancy	Women age 15-49 with a live birth in the 5 years before the survey	9,018	n/a	6,723	5,062	6,368

Table 2 (Continued)

Indicator	Definition	Population base	Sample Size				
			2006 DHS	2010 AP	2012-13 DHS	2015 MIS	2018 DHS
Four or more antenatal care visits (ANC)	Percentage of women with four or more ANC visits for their most recent pregnancy	Women age 15-49 with a live birth in the 5 years before the survey	9,018	n/a	6,723	5,062	6,368
IPT1	Percentage of women who received at least one dose of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey	5,581	n/a	3,952	3,007	3,926
IPT2	Percentage of women who received at least two doses of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey	5,581	n/a	3,952	3,007	3,926
IPT3	Percentage of women who received at least three doses of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey	5,581	n/a	3,952	3,007	3,926
Percent of women who received at least one dose of IPTp among those who attended at least one ANC visit	Percentage of women who received at least one dose of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey who attended at least one ANC visit	4,001	n/a	3,020	2,371	3,092
Percent of women who received at least two doses of IPTp among those who attended at least two ANC visits	Percentage of women who received at least two doses of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey who attended at least two ANC visits	3,564	n/a	2,783	1,039	2,795
Percent of women who received at least three doses of IPTp among those who attended at least four ANC visits	Percentage of women who received at least three doses of SP/Fansidar during their most recent pregnancy	Women age 15-49 with a live birth in the 2 years before the survey who attended at least four ANC visits	1,936	n/a	1,676	1,089	1,676

2.2.2 Analysis

Tests of association were performed with the above indicators and background characteristics of household head (for ITN indicators) or women's education level (for IPTp indicators), household wealth quintile, place of residence, and region. These tests identify disparities in the indicators across subpopulations within each survey.

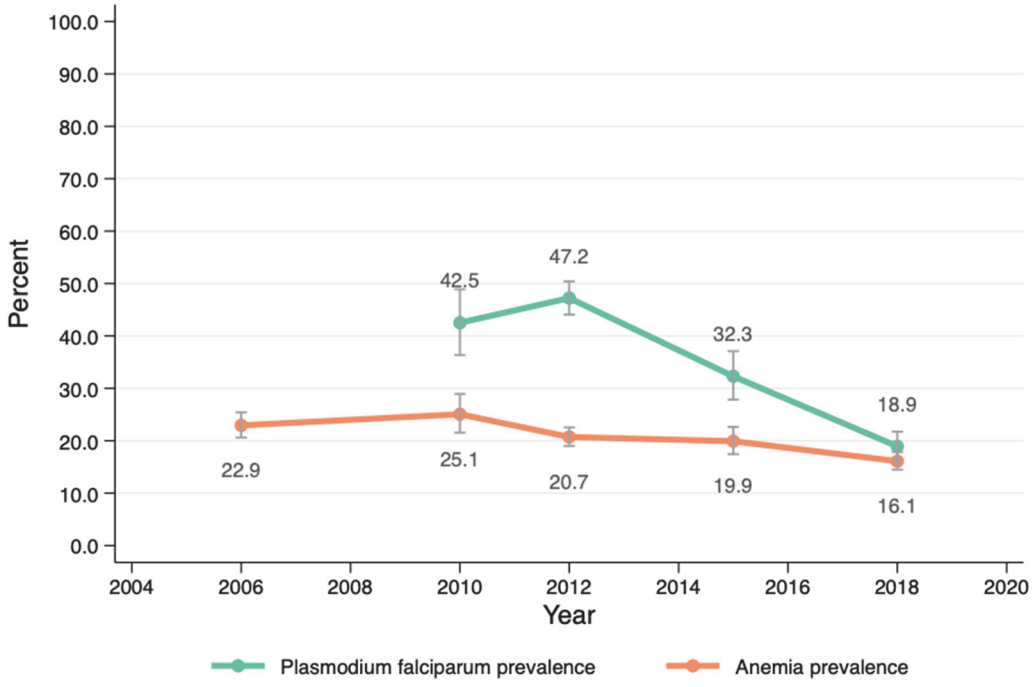
In addition, tests of differences in proportions determined if the differences between surveys (both nationally and within subgroups) were statistically significant. These results are shown in plots with error bars. The values of the overall differences and by subgroups are found in the appendix tables. Statistical testing was adjusted for the sample design and weights. Stata 16 was used to make all calculations. The national estimates and the estimates used to produce the figures are shown in the appendix tables.

3 RESULTS

3.1 Parasitemia and Anemia

The prevalence of *plasmodium falciparum*, as measured with RDTs, has declined since 2012-13, from 47% nationally to 19% in 2018 (see **Figure 3**). Sikasso, Segou, and Mopti observed the largest overall declines (see **Figure 4**). Anemia prevalence has marginally declined over the same period. Declines in anemia were more pronounced in the lower wealth quintiles and rural households (data not shown).

Figure 3 Parasitemia and anemia in children 6-59 months



3.1.1 Regional trends in parasitemia and anemia

Figure 4 Parasitemia (via RDT) in children age 6-59 months by region

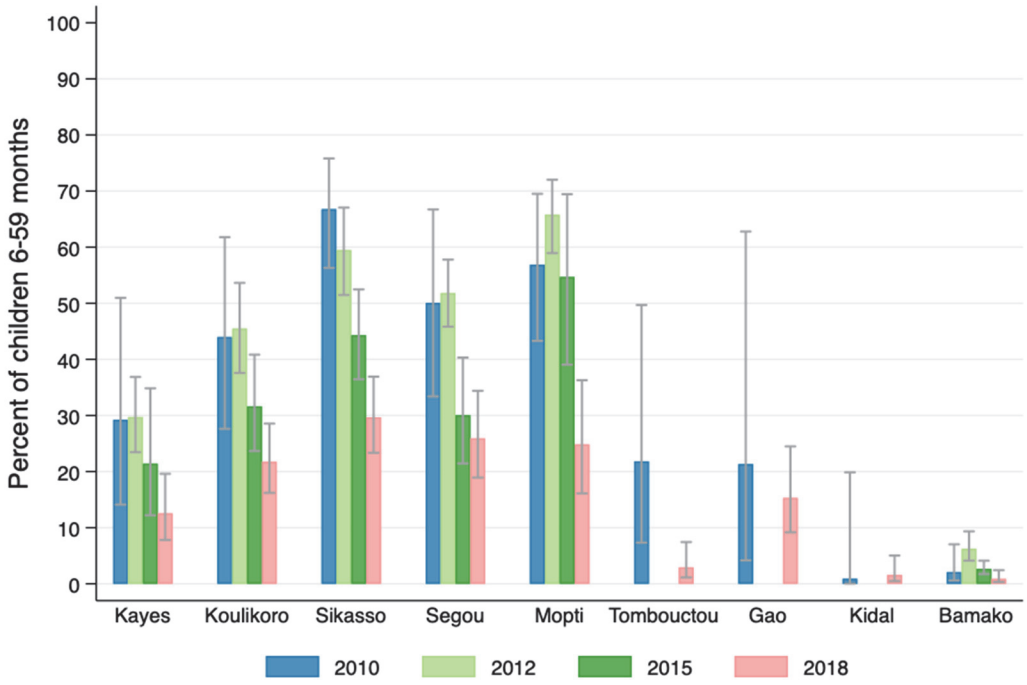
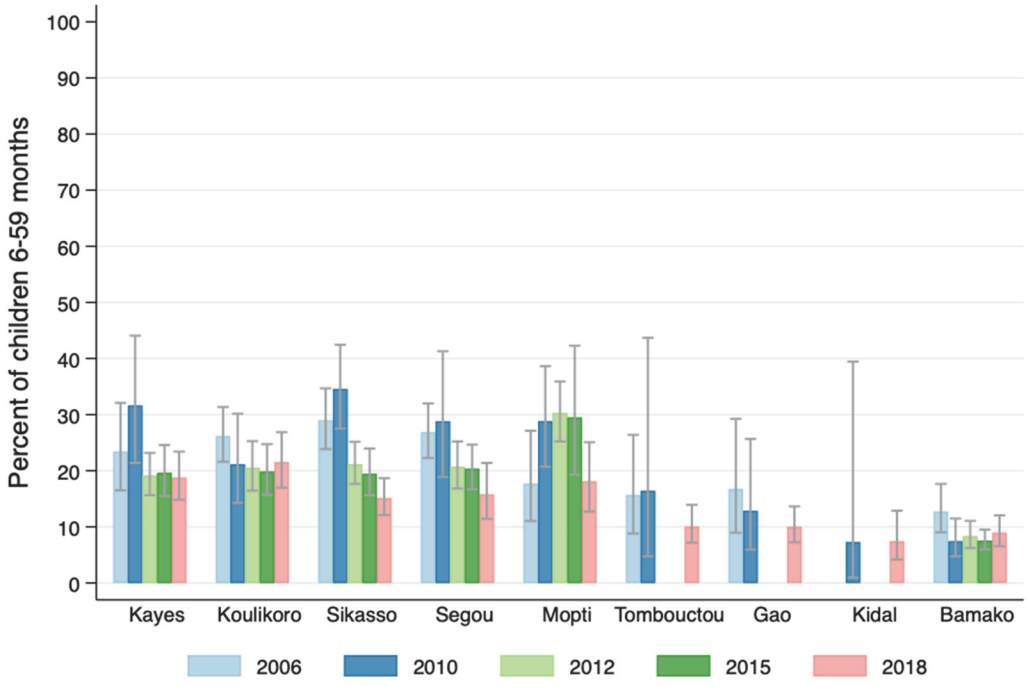


Figure 5 Anemia in children age 6-59 months by region



3.2 Insecticide-Treated Nets

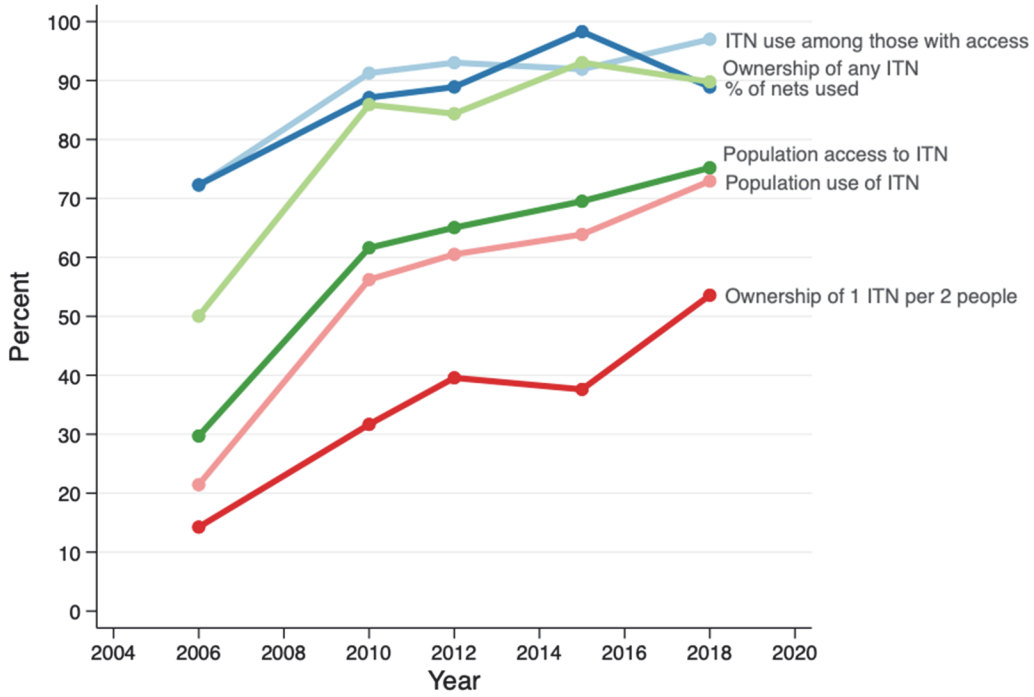
Universal coverage of long-lasting insecticidal nets (LLINs) is a cornerstone of NMCP's malaria control strategy in Mali. Free LLINs are distributed through mass distribution to households during universal

coverage campaigns, and through routine distribution at ANC and immunization visits that target women and infants.

Ownership of at least 1 ITN has remained above the 80% target since 2010, while population access to ITN significantly increased from 66-80%, and household universal coverage (ownership of at least 1 ITN per 2 household members) remained below 40%, with the exception of 2018 when it reached just over 50%. It should be noted that the indicator of household ownership of at least 1 ITN for two people is strongly influenced by average household size. Larger households are less likely to obtain or be able to retain sufficient ITNs for all household members (Koenker et al. 2018). In 2015, ownership of any ITN and population access had increased, while household universal coverage decreased slightly. This perplexing phenomenon may be due to the average household size of nearly nine people in the 2015 MIS. With larger average household sizes, fewer households meet the criteria for ownership of 1 net per two people. The sharp increase in 2018 of this indicator is related not only to continued distribution of ITNs, but also to an adjustment in the definition of a household in the 2018 DHS, which led to an average household size of 5.8.

The use of ITN in Mali has significantly increased in each survey, along with population ITN access (**Figure 6**). Two indicators provide insights into the extent to which Malians use available nets—first, the proportion of individuals with access who use an ITN (ITN use given access), and second, the proportion of nets used the previous night. Since 2010, both indicators have been near 90% or higher, which indicates a strong culture of net use in Mali.

Figure 6 **National ITN indicators**



3.2.1 Regional trends in ITN ownership and access

Regional trends in ITN ownership tend to reflect the timing of the most recent mass campaign. These campaigns have occurred on a regular basis in Kayes, Koulikoro, Segou, Sikasso, and Mopti. The first

universal coverage campaign did not occur in Bamako until 2015 and was not repeated in 2018 due to low prevalence. Insecurity in Gao, Timbuktu, and Kidal delayed the first campaigns until 2016, but the second campaign in these regions was implemented 3 years later in 2019. However, despite the high population ITN access in Segou, Mopti, and Koulikoro, malaria prevalence remains high in these regions.

Similar to the household ownership indicators, ITN access is primarily influenced by the timing of the most recent campaign. There are significant increases in population ITN access in 2018 in all regions, except Kidal, when compared to previous years (**Figures 7-11**). When population ITN access from the 2018 DHS is plotted as a function of time since the most recent mass campaign, we observe a strong linear trend, with ITN access falling approximately 3% points every 12 months on average. This is a markedly slower rate of decline compared to other countries, which have an average 7.5 % point decline every 12 months (data not shown).

Bamako, in particular, which at the time of the 2018 DHS had not had a mass ITN campaign in over 3 years, had a level of population ITN access of 62%. The reason for this relatively high access, given the lack of mass campaigns, is that many Bamako residents have purchased nets. In 2018, only 29% of nets in Bamako reportedly came from a campaign, and as expected, most (but not all) of these campaign nets were 3 years old. The ITNs from ANC and EPI accounted for another 18% of all nets in Bamako, while 45% of the nets in Bamako were purchased at a shop or market. Of those purchased nets, only 14% were untreated nets or nets with unknown treatment status. The purchased nets were primarily PermaNet 2.0 (39%) and Yorkool (11%), with 24% classified as an unknown type of ITN. These purchased ITNs appear to have contributed to the slower rate of decline of ITN access than seen in other countries.

In Bamako, where all households were in the fourth and highest wealth quintile, 55-58% of households had purchased a net. However, purchase behavior in Mali was not equitable nationwide. In the lowest wealth quintile, only 17% of households had purchased a net. In the middle three quintiles, 20-25% of households had purchased a net, although in the highest quintile, 47% of households had purchased a net.

Figure 7 **Household ownership of any ITN by region**

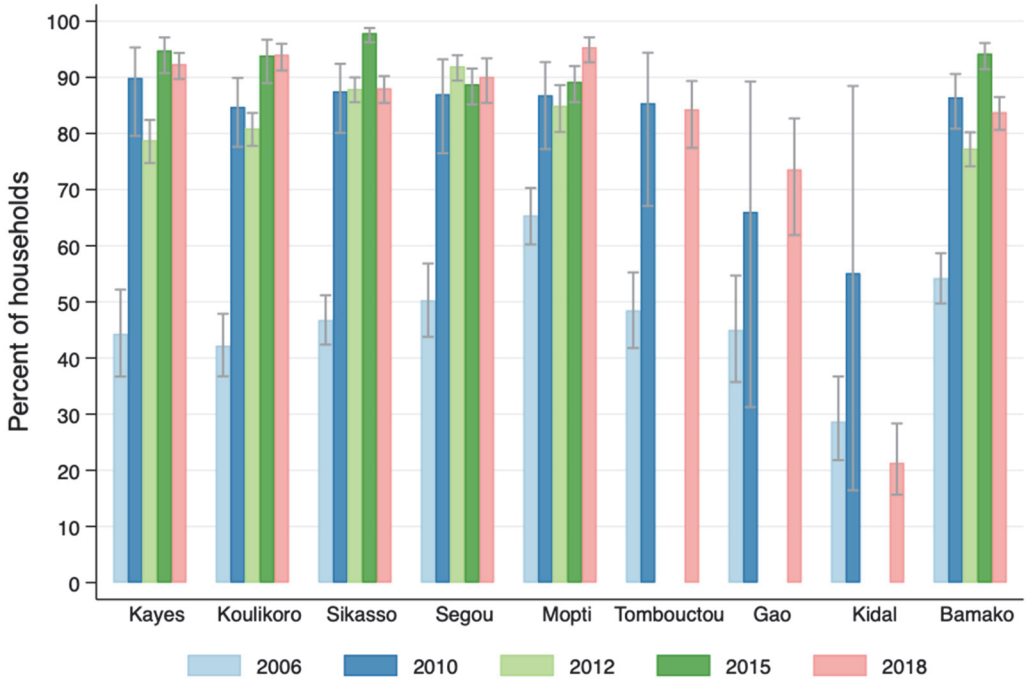


Figure 8 **Household ownership of at least 1 ITN per 2 people by region**

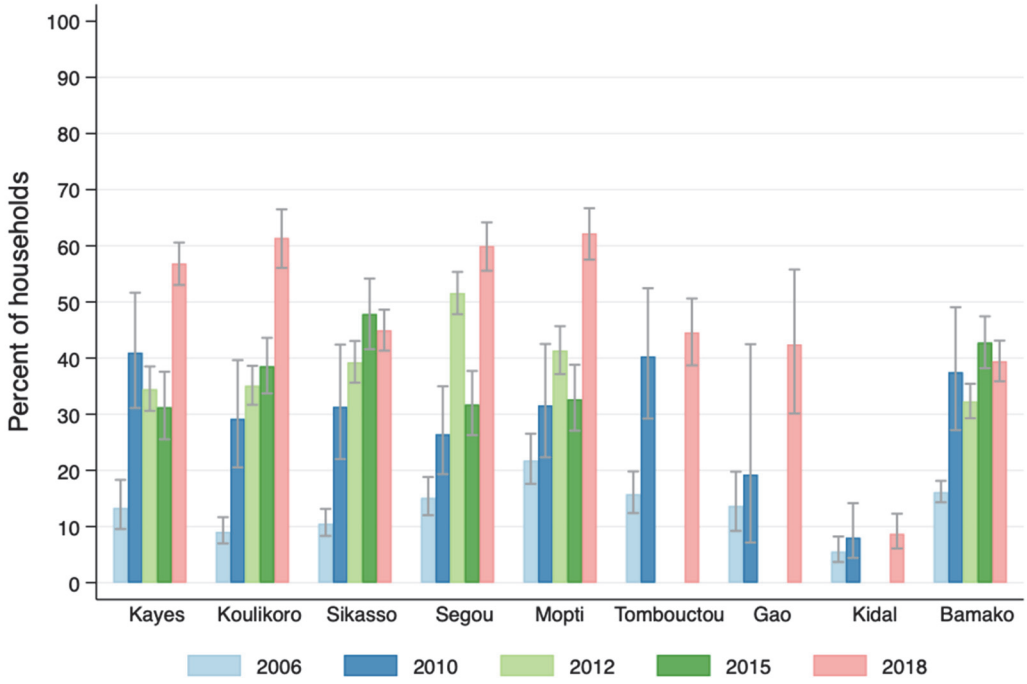


Figure 9 **Population access to ITN by region**

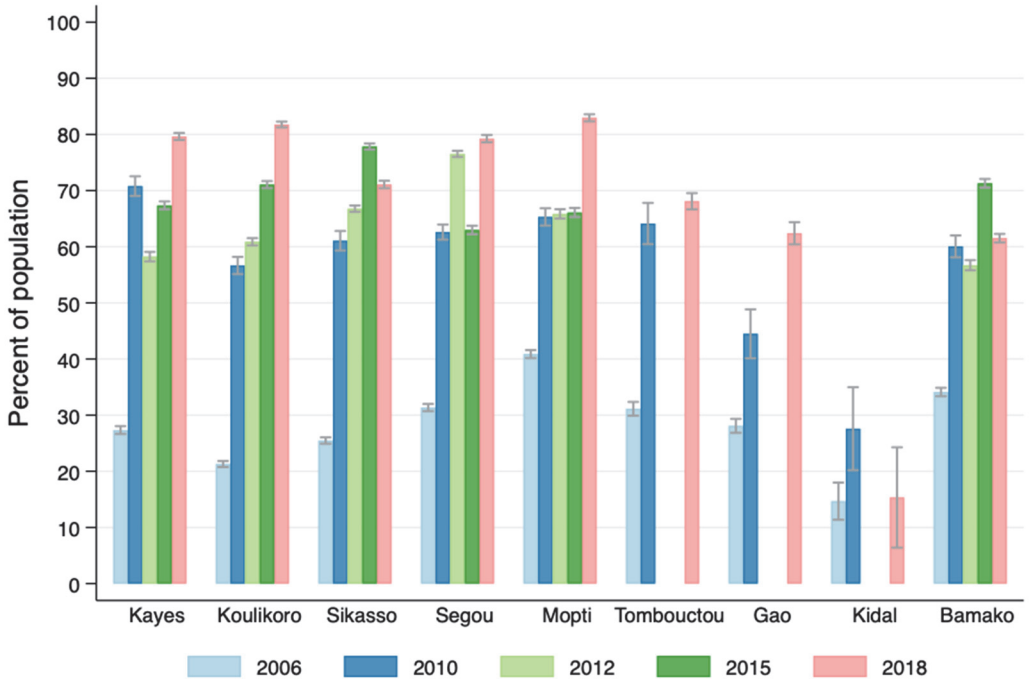


Figure 10 **Population access to ITN as a function of time since the most recent distribution. Data points include one or more regions based on date of the survey fieldwork and distribution dates of the most recent campaign.**

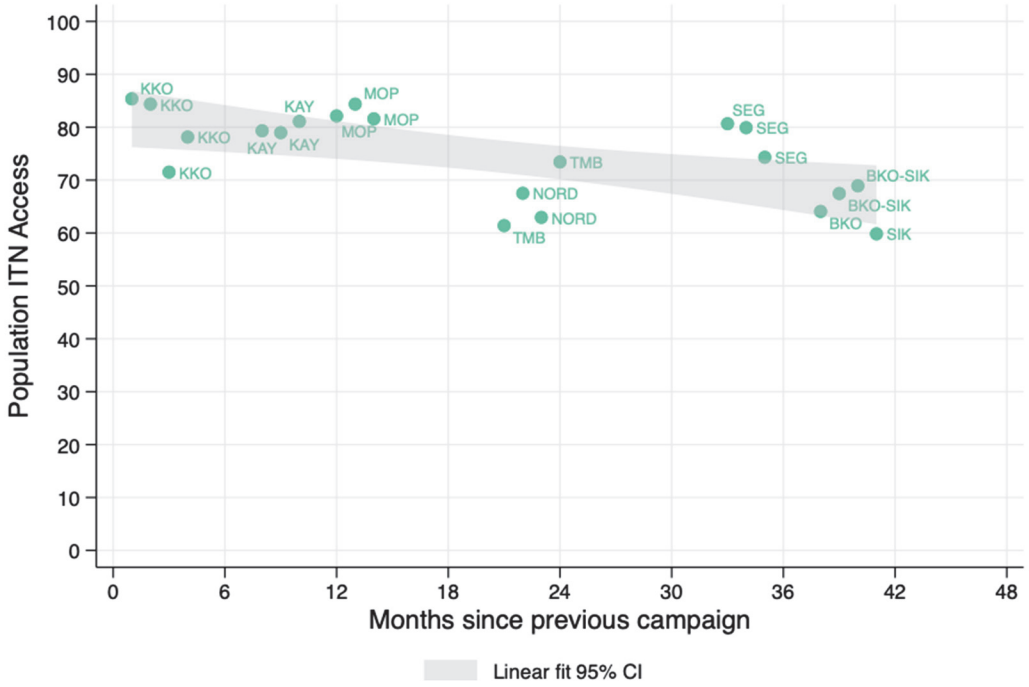
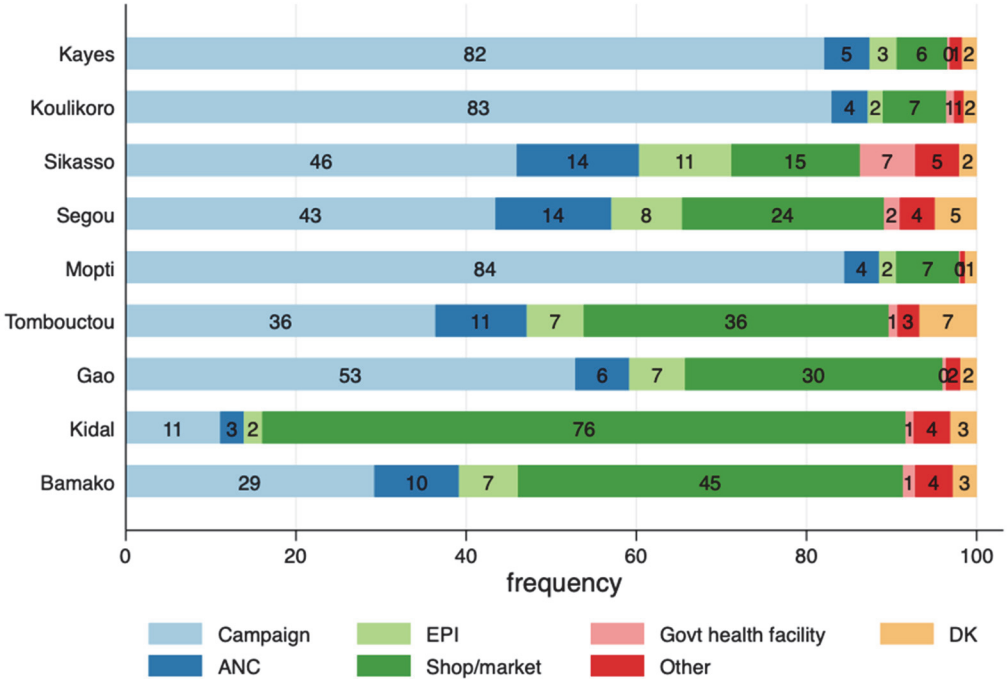


Figure 11 Source of ITNs by region



3.2.2 Regional trends in ITN use

Where population ITN access is at or near 80%, population use of ITNs also approaches 80% targets. This demonstrates the propensity to use ITNs when they are available. Accordingly, the ITN use: access ratios are near 1.00 in all southern regions except Bamako, where the ratio is marginally lower at 0.90. This ratio is still above targets and indicates a strong net use culture even in the urban areas of Mali where the malaria risk is generally lower. The Kidal estimates indicate an upward trend, although the limited sample size prevents statistical testing. (See **Figures 12-14**.)

While ITN use: access ratios remain the same or have slightly increased from 2015 to 2018, the percent of nets used the previous night declined from 98% to 89% in the same period. Given that overall levels of ITN access are higher in 2018, some households may have extra nets, which might lower the overall rate of nets used the previous night, while individual use of an ITN among those with access increased.

Figure 12 Population use of an ITN the previous night by region

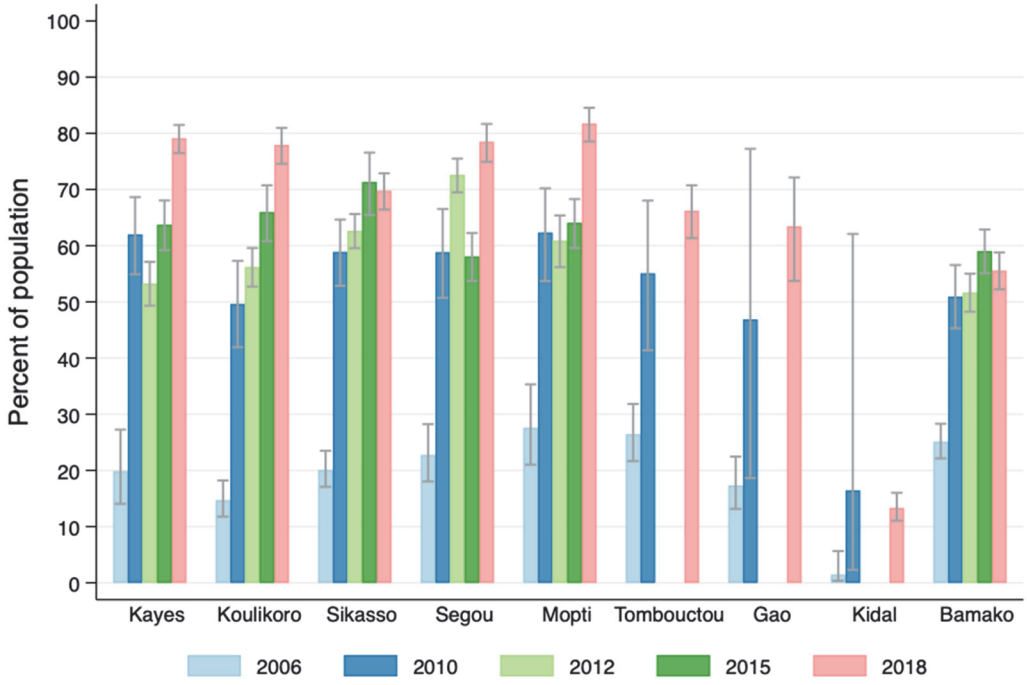


Figure 13 ITN use: access ratio by region

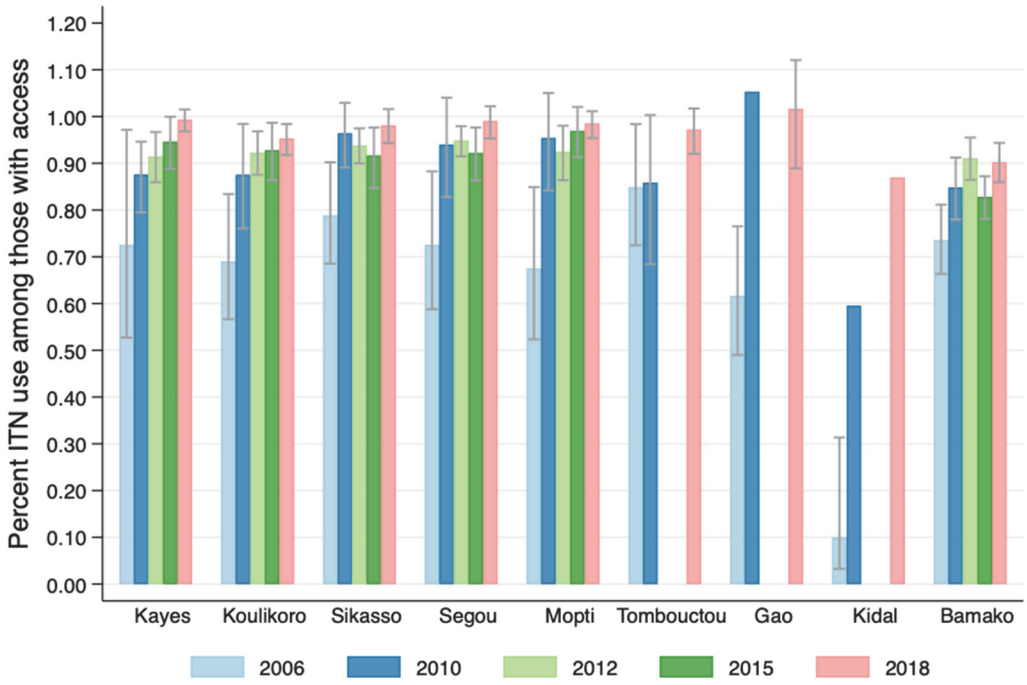
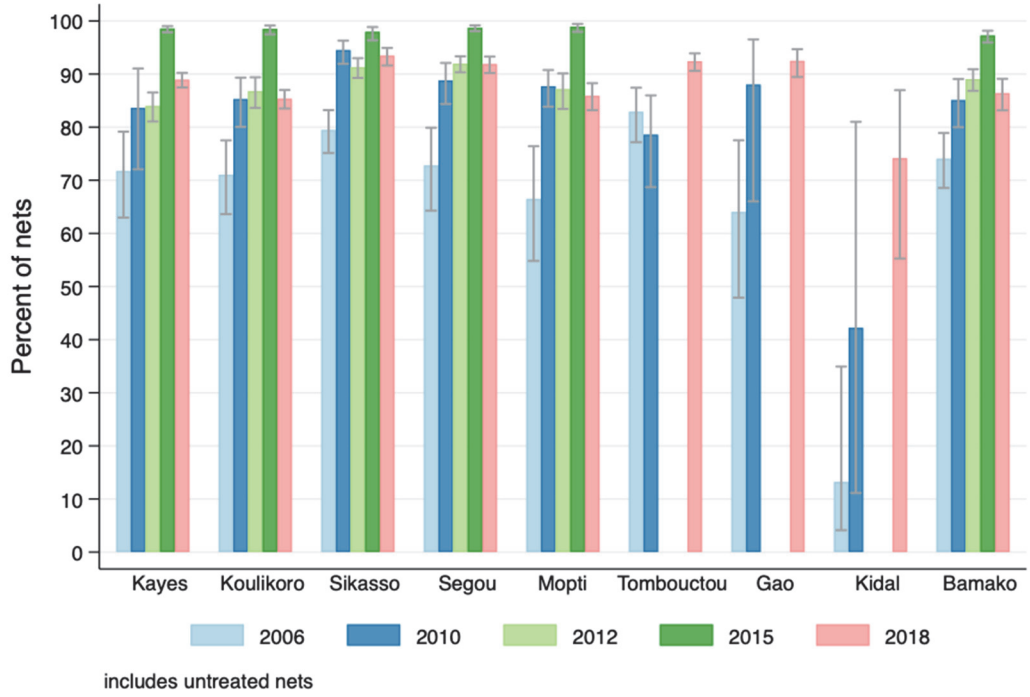


Figure 14 Percent of nets used the previous night by region



3.2.3 Regional trends in children's ITN use

Children's ITN use mirrors the same trend as the overall population, with slightly lower rates in Bamako. (See **Figures 15-16**.) In households with at least 1 ITN (which still may not have sufficient ITNs for all children under age 5 in the household), ITN use by children under age 5 exceeds 80% except in Bamako (71%) and Kidal (65%), where the malaria risk is low. The findings demonstrate the widely observed phenomenon that when levels of population ITN access are high, children under age 5 have higher rates of ITN use (data not shown).

Figure 15 Use of ITN by children under age 5 by region

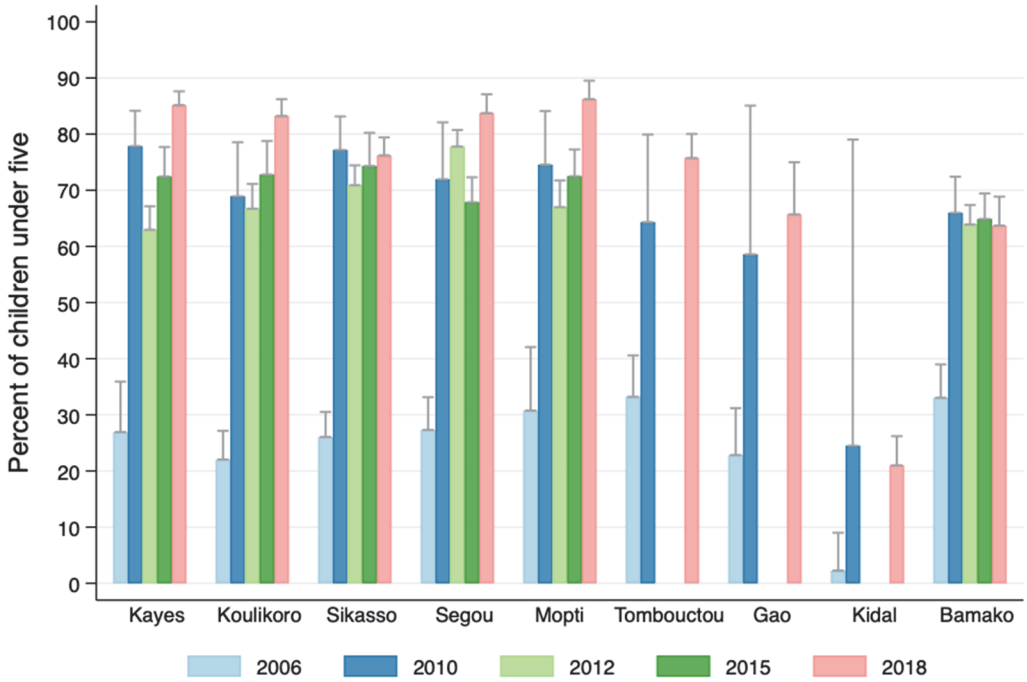
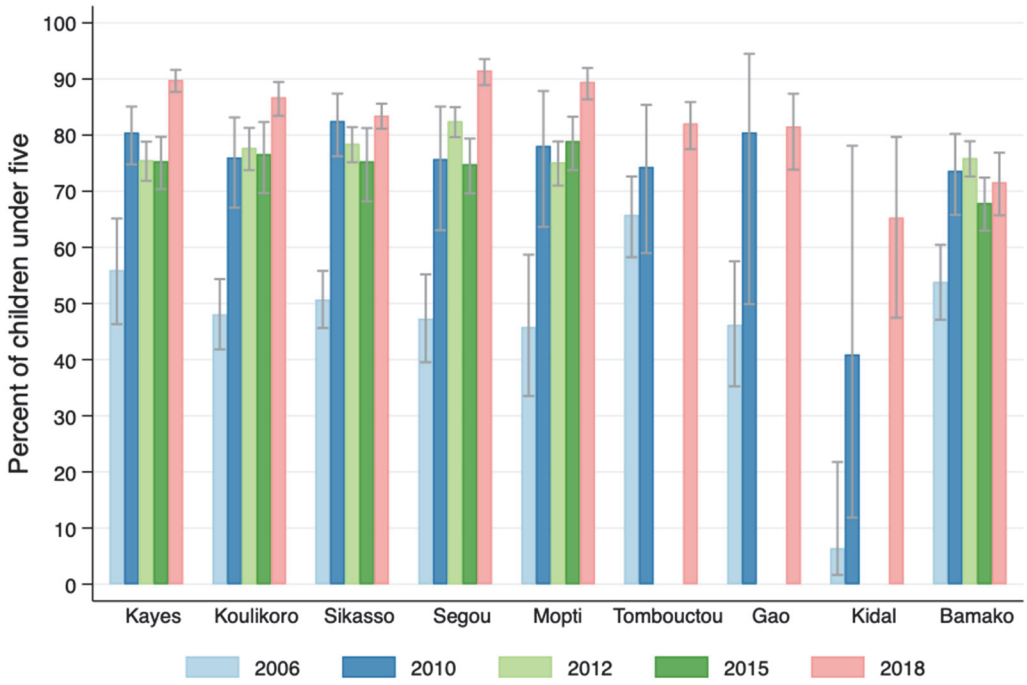


Figure 16 Use of ITN the previous night by children under age 5, in households with at least 1 ITN



3.2.4 Regional trends in pregnant women's ITN use

The use of ITN by pregnant women has increased over the period in all regions except Bamako and Gao, and in 2018, this exceeded 80% in all regions except Kidal and Bamako. (See **Figures 17-18**.) The rates in Kidal are low, and should be interpreted with caution given the limited sample size in 2018.

Figure 17 Use of ITN the previous night by pregnant women

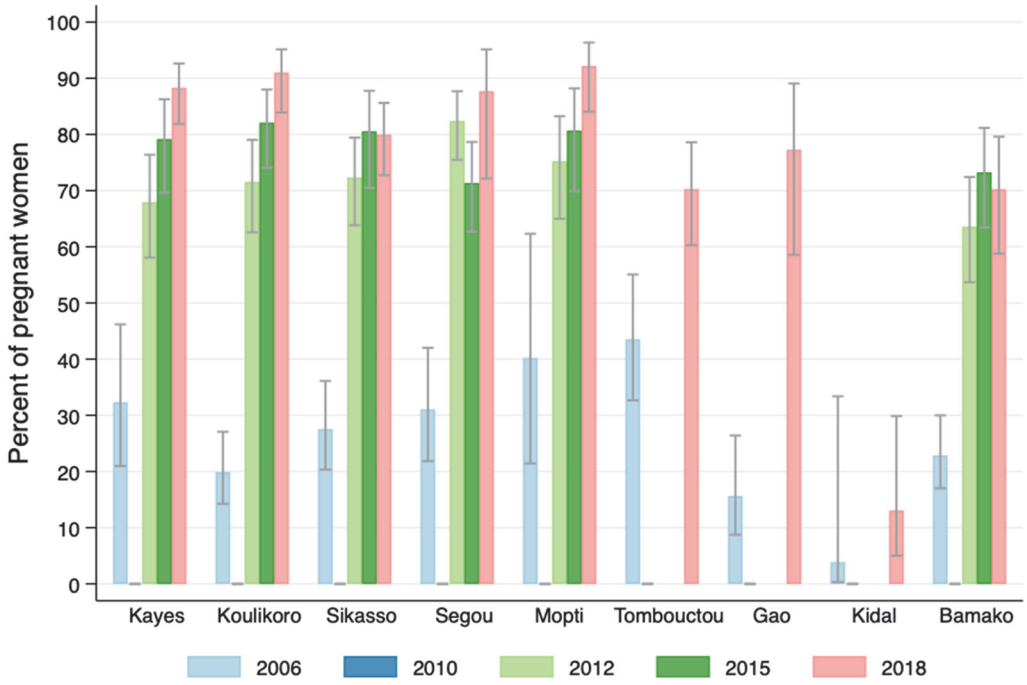
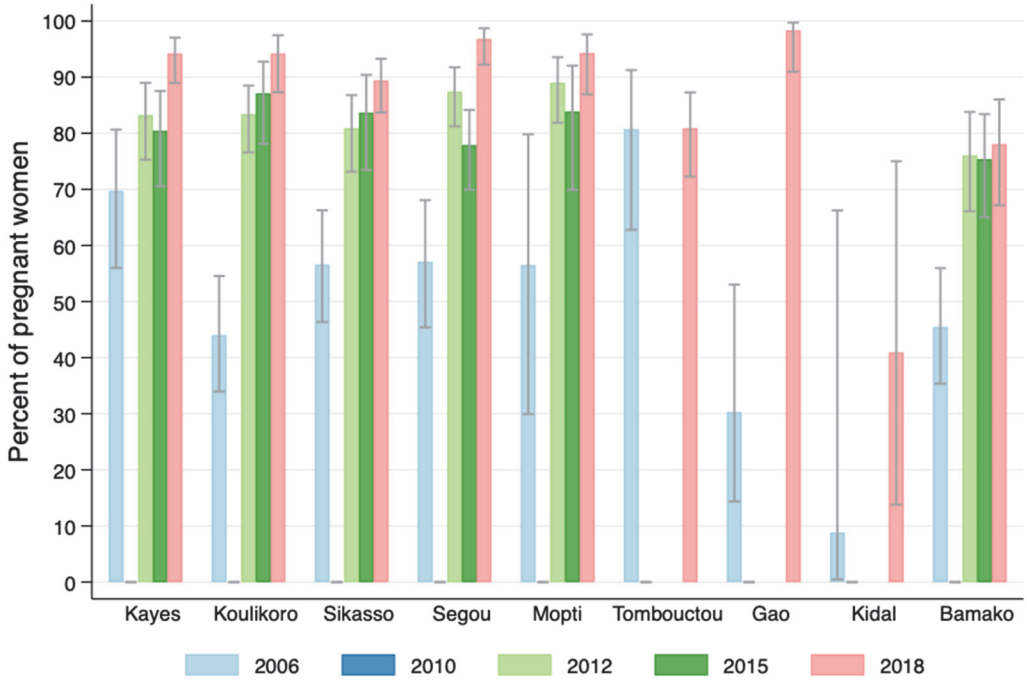


Figure 18 Use of ITN the previous night by pregnant women, in households with at least 1 ITN

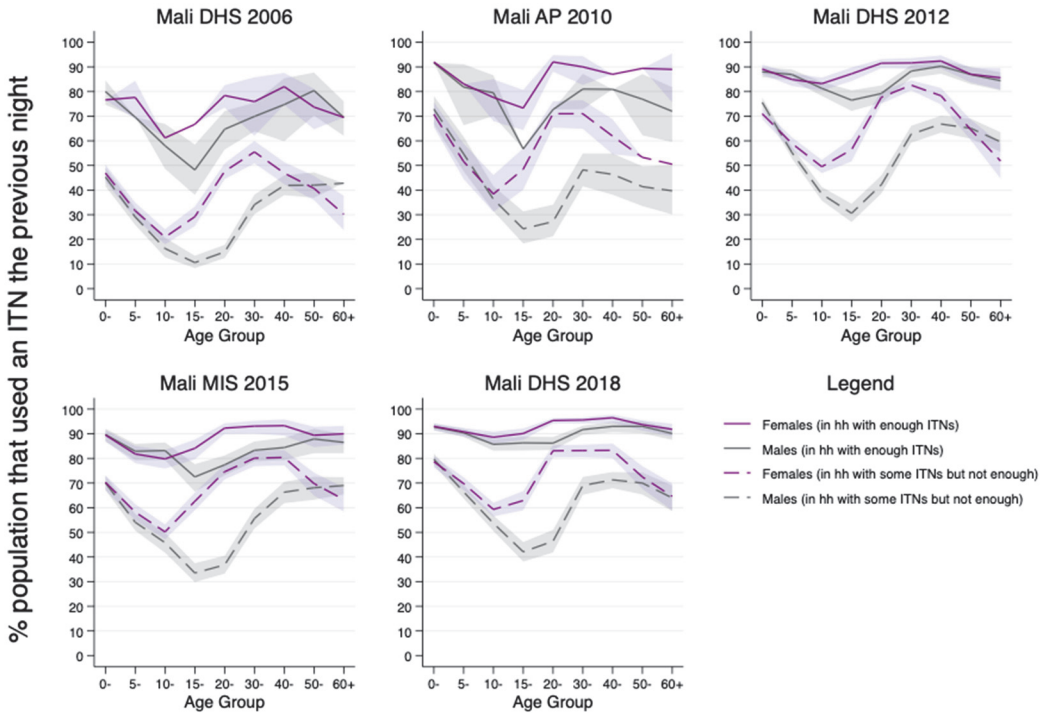


3.2.5 Age and gender trends in ITN use

To better illustrate age and gender disparities in ITN use, we plotted ITN use at the national level for each survey for women and men in nine age groups, following Olapeju et al. (2018). (See **Figure 19**.) Solid lines indicate men and women living in households that own at least 1 ITN for two people, while dashed lines

indicate men and women living in households with some but insufficient ITNs. The ITN use is highest in households with a sufficient number of ITNs. However, even in those households, women of reproductive age have higher ITN use than men in the same age group. There are no disparities by gender for children under age 5, who have the highest ITN use rates, which are similar to those of women of reproductive age with whom they are often sharing a net. Young men age 15-24 have the lowest rates of ITN use, which suggests that they are not prioritized in households with insufficient nets.

Figure 19 Age and gender trends in ITN use, stratified by household net supply



3.2.6 Seasonal trends in ITN use

Malaria transmission in Mali is seasonal and concentrated during the late rains and early dry season. Peak transmission occurs in October-November and remains high through December-January (Toure′ et al. 2016). Transmission occurs year-round in the Sudano-Guinean zone in the south. Analysis of ITN use-given-access by month of survey fieldwork shows that ITN use follows a similar seasonal pattern, with significant increases in a given month since 2006. This suggests improved behaviors of net use. It must be noted that regional samples for any given month are unbalanced. The implementation of the most recent surveys during the transmission season means that data are scarce for ITN use in the dry season in Mali. (See **Figures 20-21.**)

Figure 20 Seasonal trends in ITN use given access, national

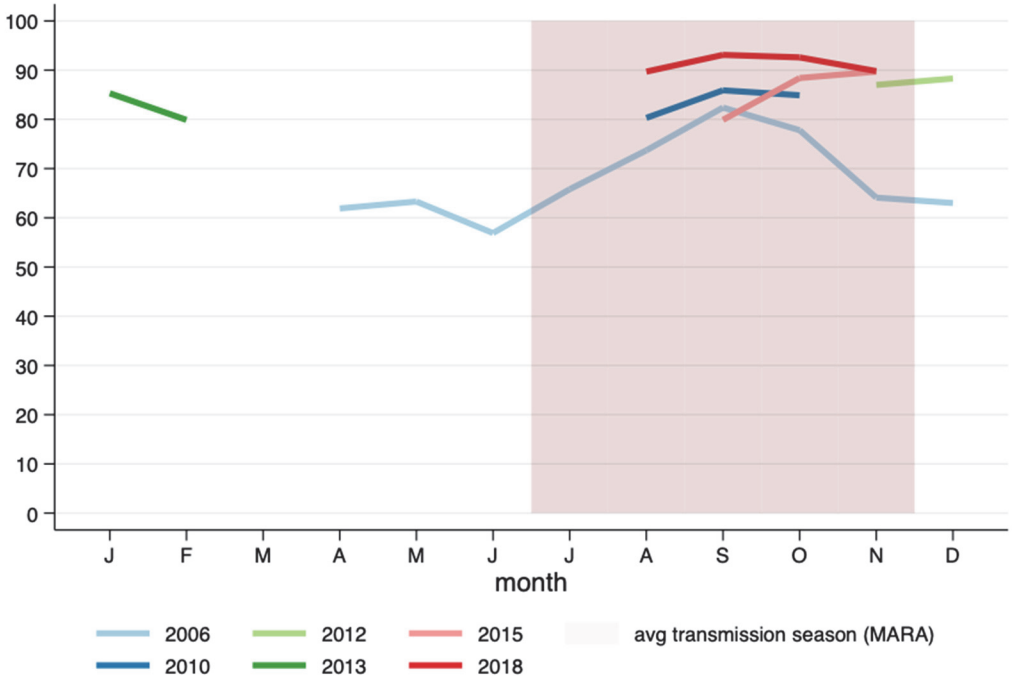
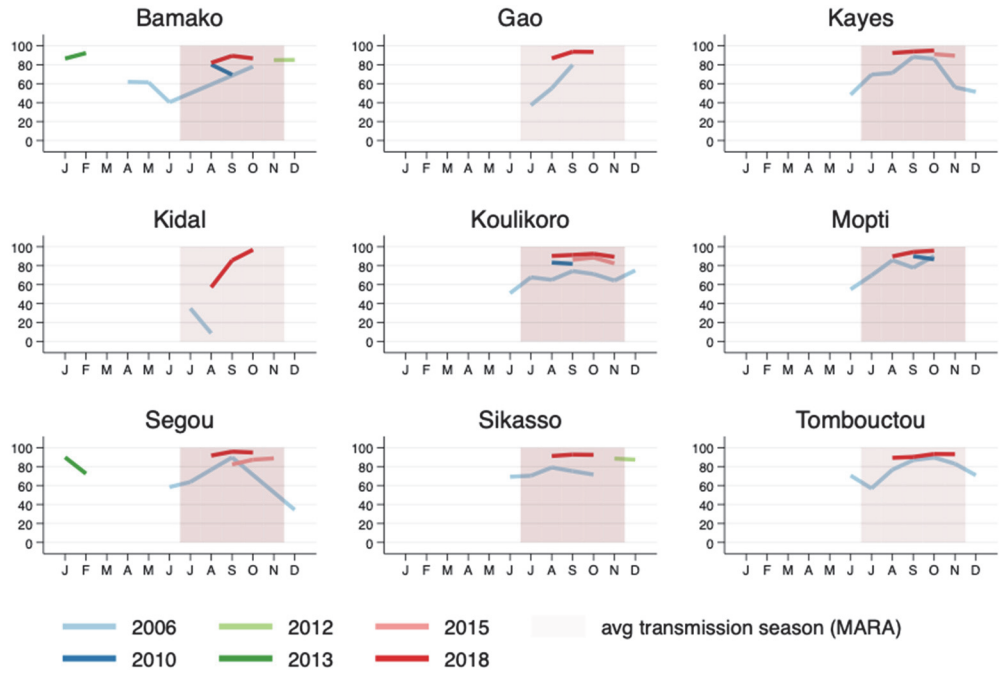


Figure 21 Seasonal trends in percent ITN use given access by region



3.3 Intermittent Preventive Treatment of Malaria in Pregnancy

Malaria infection during pregnancy is a key contributor to maternal and neonatal morbidity in malaria endemic countries such as Mali. Malaria-associated maternal anemia contributes to an increased risk of death before and after childbirth, as well as an increased risk of preterm birth and low birth weight, which contribute to neonatal mortality. The WHO recommends three interventions to prevent malaria in

pregnancy—sleeping under ITNs and in high and medium transmission countries in sub-Saharan Africa such as Mali, (IPTp) with SP, and prompt treatment of malaria (WHO 2019).

Since 2007, Mali has had a policy of providing SP to pregnant women at no charge. Since 2006, just prior to the policy change, overall coverage of IPTp increased, with 2018 rates of IPTp1+ at 74% in 2018, IPTp2+ at 55%, and IPTp3+ 28%.

National policy in Mali indicates that SP should be taken at the health facility under directly-observed therapy (DOT). This means that IPTp rates are directly affected by the number and timing of ANC visits made by women, because those who start later or make fewer visits will have fewer opportunities to receive SP. To assess the provision of IPTp in the context of these opportunities, we calculated three programmatic indicators: 1) percent of women who received at least 1 dose of SP (IPTp1) among women who made at least 1 ANC visit; 2) percent of women who received at least 2 doses of SP (IPTp2) among women who made at least 2 ANC visits; 3) percent of women who received at least 3 doses of SP (IPTp3) among women who made at least 4 visits. As with the ITN indicator of use in the context of access, receipt of SP in the context of ANC visits provides a picture of the IPTp-gap—the proportion of women who did not receive sufficient doses despite attending ANC. Thus, the ANC visits where women did not receive SP represent missed opportunities by the health system to achieve the NMCP goals.

Although 90% of women who attended ANC at least once reported receiving at least one dose of SP in 2018 and 70% attending 2 or more ANC visits received at least 2 doses of SP, only 42% of women who made 4 ANC visits received 3 or more doses of SP. Nonetheless, the trend over time for these three indicators is significantly positive. There were no significant differences for IPTp3-ANC4 associated with wealth quintile, residence, or region. (See **Figures 22-23**.)

There are important methodological challenges in the measurement of IPTp uptake. Recent studies indicate that health centers may not administer SP by DOT, give SP at one-month intervals through second and third trimesters, or provide SP free-of charge (Hurley et al. 2016; Klein et al. 2016). Women are instructed to take many drugs throughout pregnancy (iron folate, treatment for other illnesses) and may not remember exactly what they took for a pregnancy during the 33 months prior.

3.3.1 National trends in IPTp

Figure 22 Intermittent preventive treatment rates

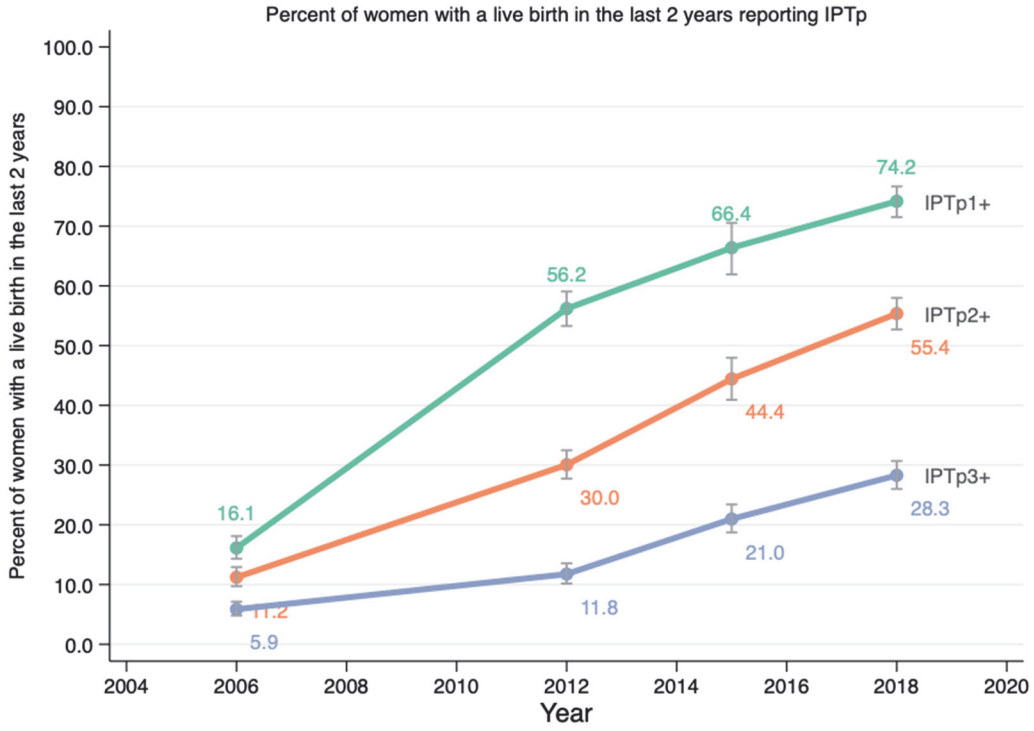
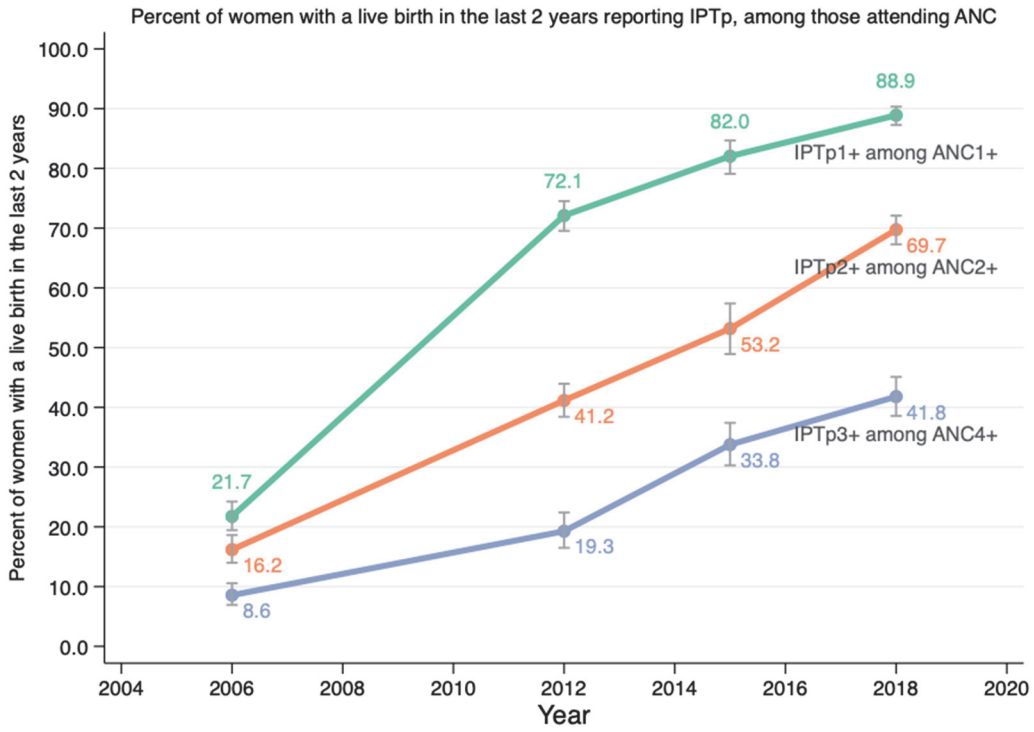


Figure 23 Intermittent preventive treatment rates for women who attend ANC



3.3.2 Regional trends in IPTp

The Bamako, Sikasso, and Koulikoro regions saw significant increases in IPTp3 among women who made at least 4 ANC visits from 2015 to 2018. All regions except Bamako saw significant increases in IPTp2 among women who made at least 2 ANC visits from 2015-2018. Only Segou, Kayes, and Koulikoro observed significant increases in the proportion of women who received at least 1 dose of SP among women who made at least 1 ANC visit. The three northern regions lag significantly behind the southern regions in receipt of IPTp. (See **Figures 24-26**.)

Figure 24 IPTp1 by region

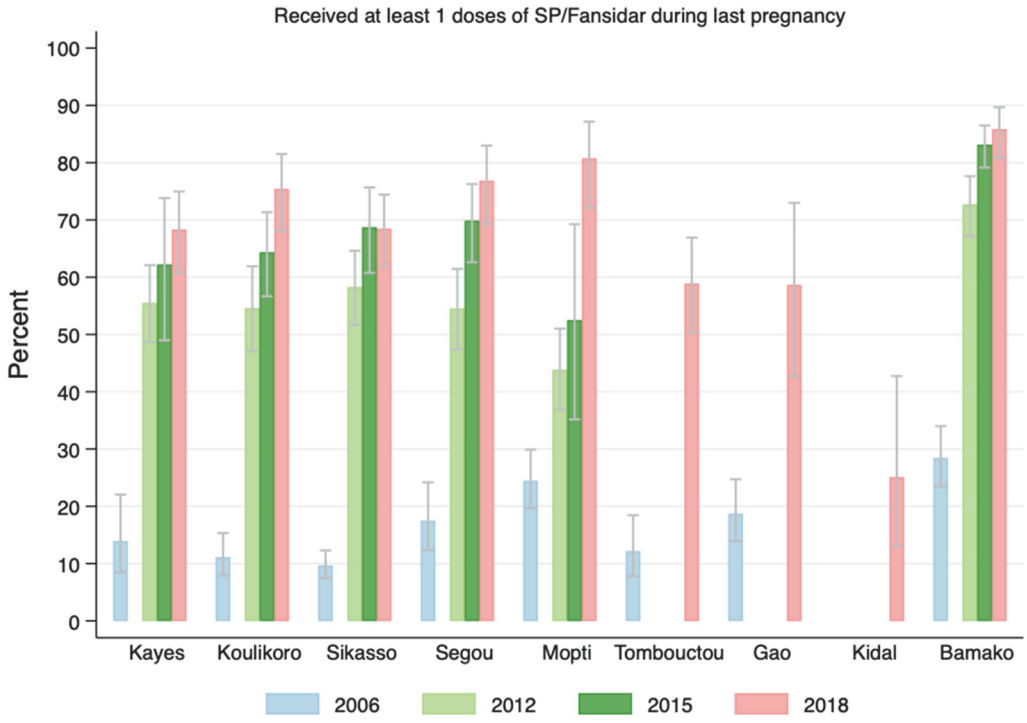


Figure 25 IPTp2 by region

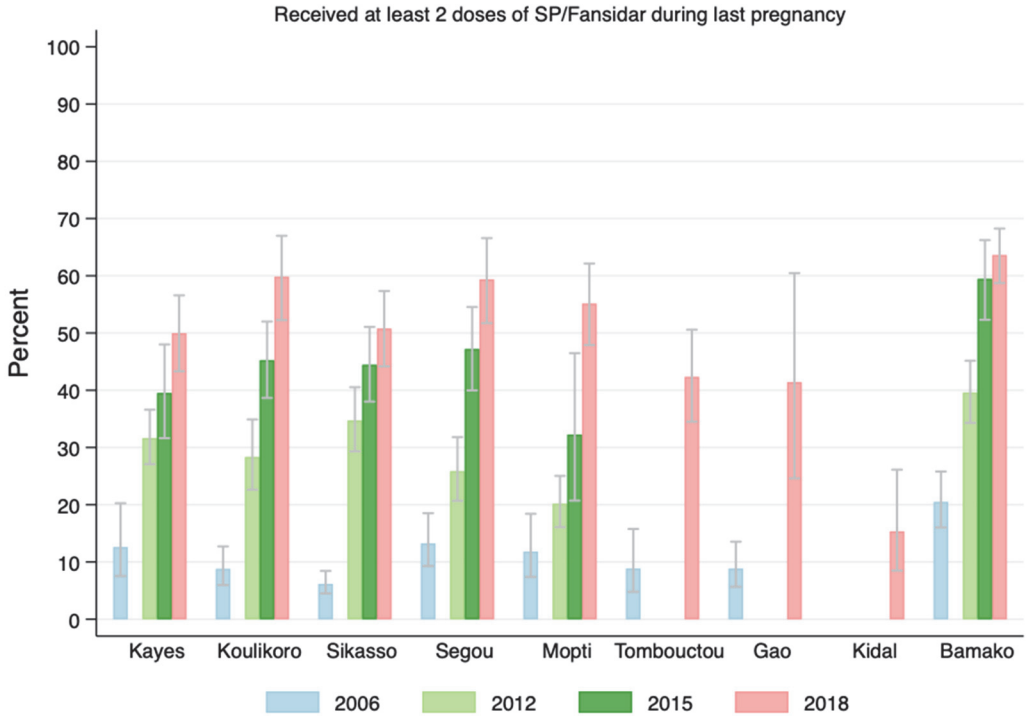
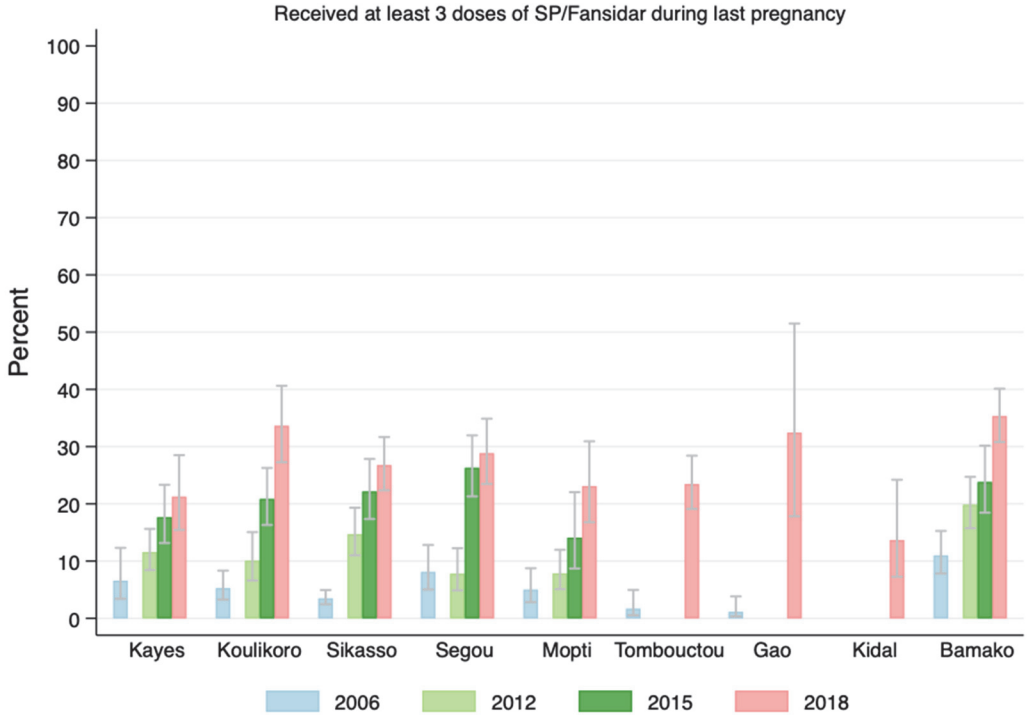


Figure 26 IPTp3 by region



To improve rates of IPTp3, it is crucial to discern if the challenges lie primarily in SP provision to pregnant women (provider behavior and supply chain management) or if the challenges are primarily in insufficient ANC attendance by pregnant women (client behavior, mediated by health system service availability and quality).

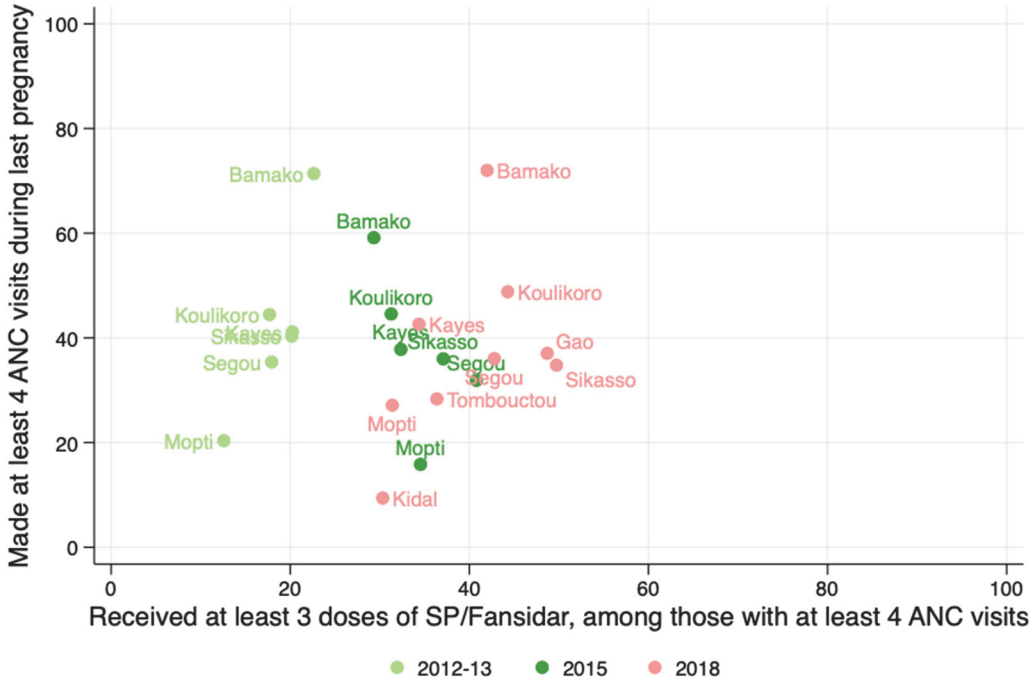
Figure 27 plots ANC4 attendance in 2012-13, 2015, and 2018 against the proportion of pregnant women who received IPTp3+ who attended at least 4 ANC visits. The y-axis, ANC4 attendance, represents client behavior, and the x-axis represents provider behavior/supply chain performance.

In a comparison of the changes over time on both axes, there is little change on the y-axis, with each region somewhat stable in terms of overall ANC4 attendance. On the x-axis, however, there have been significant increases, which illustrate that the gains in overall IPT3 uptake are not due to increased ANC attendance, but rather to improvements in the provision of SP at facilities and in provider administration of SP to pregnant women.

In Bamako, ANC4 attendance is reasonably high at 60-70%, which leaves only slight room for improvement in terms of ANC attendance. However, there is significant room for improvement in provider behavior/supply chain performance, the area where efforts should be focused to improve this indicator in Bamako.

Most other regions have ANC4 attendance and IPTp3-if-ANC4 rates of between 30-50, which leave significant room for improvement in both client behavior and provider behavior/supply chain. Kidal is an outlier that should be interpreted with caution given the limited sample size in that region.

Figure 27 Comparison of ANC4 and IPTp3 coverage 2012-2018



3.3.3 Regional trends in IPTp among women who attend ANC

Figure 28 IPTp1 among women who attend at least 1 ANC visit

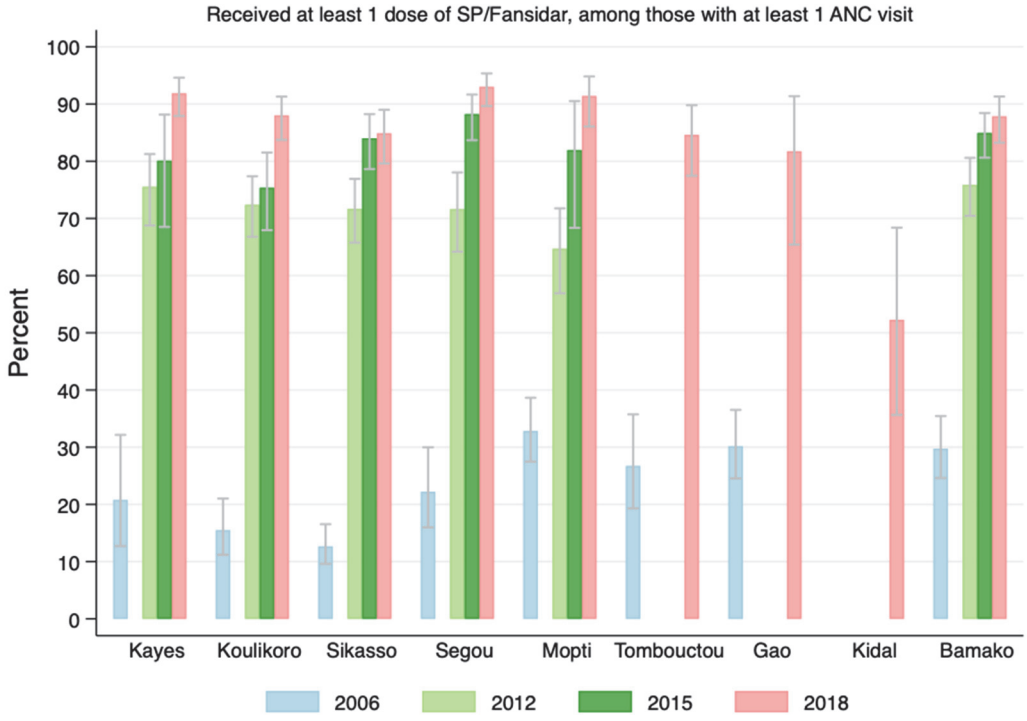


Figure 29 IPTp2 among women who attend at least 2 ANC visits

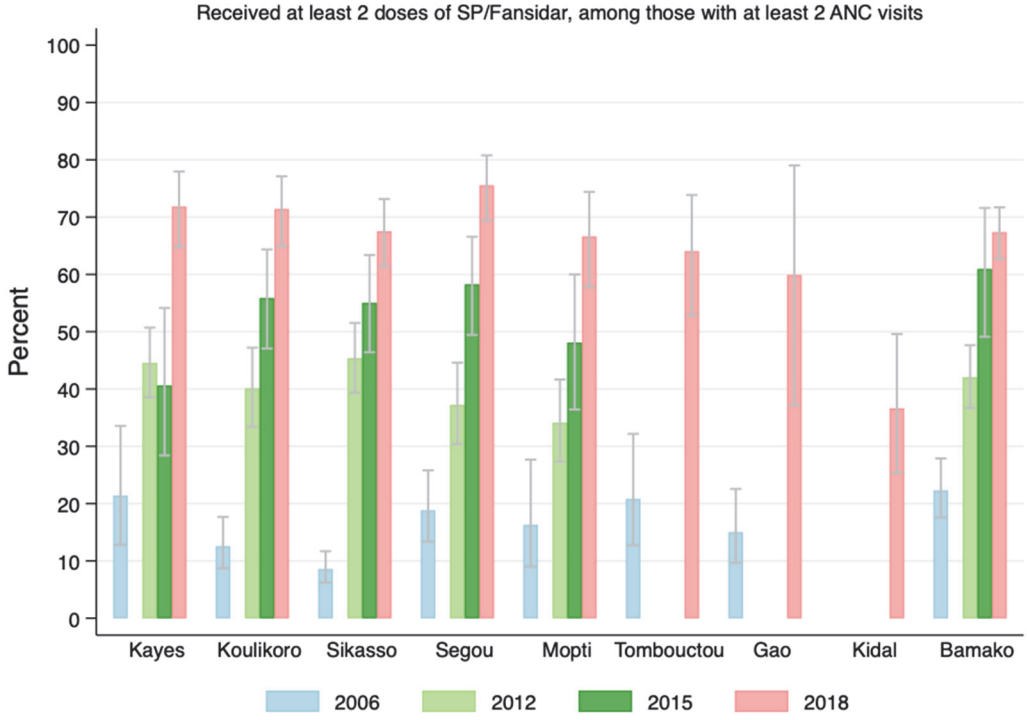
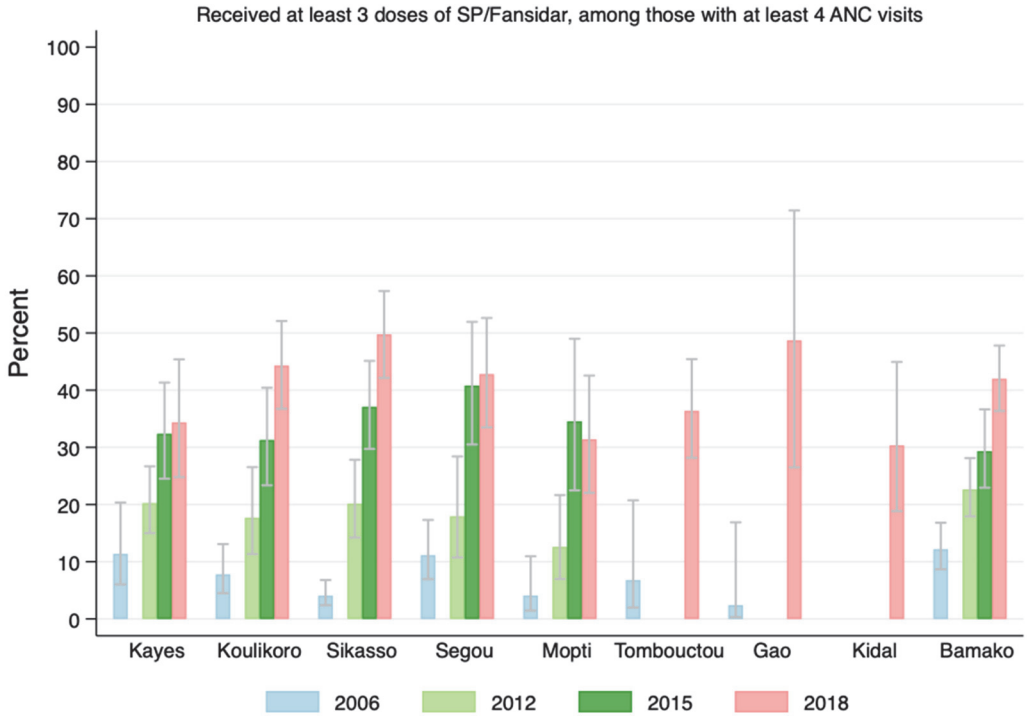


Figure 30 IPTp3 among women who attend at least 4 ANC visits

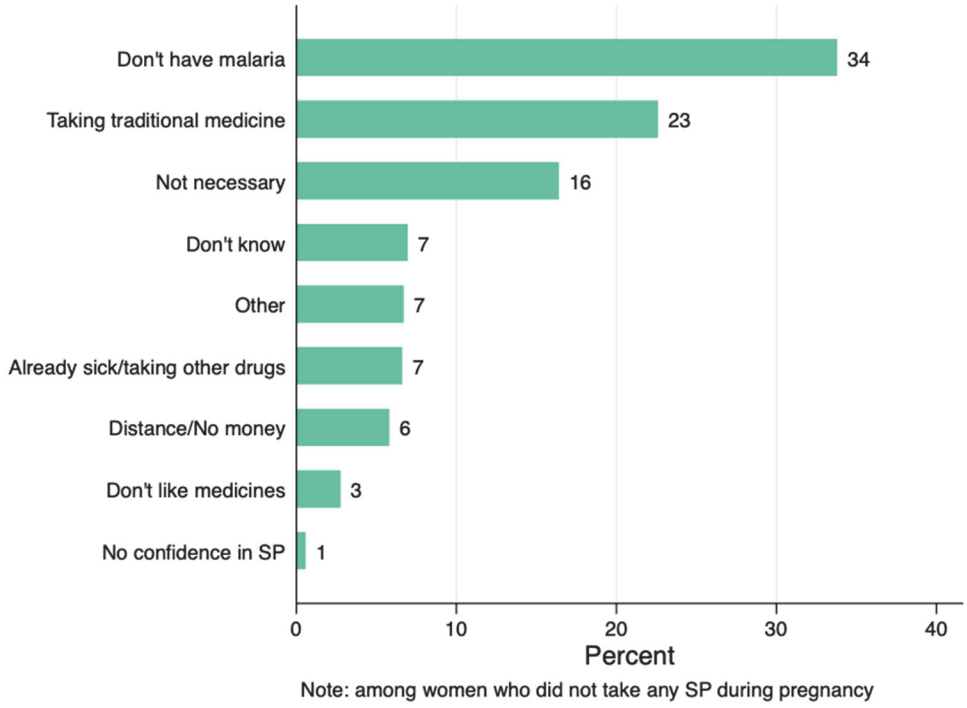


3.3.4 Reasons for not taking SP during pregnancy

The 2015 MIS included questions on why women did not take any SP for malaria prevention in pregnancy. Women who responded "no" to the question were asked "During this pregnancy, did you take medicine to prevent malaria?" Women who took the medicine but did not mention SP on the list of medicines taken to prevent malaria were also asked that question.

The most frequent response (34% overall) was "I don't have malaria," followed by "taking traditional medicine" (23%—most frequent in Sikasso and least frequent in Bamako) and "not necessary" (16%). Combining "I don't have malaria" with "not necessary" represents 50% of reasons given for not taking any medication. This may reflect an assumption that malaria medication in pregnancy is given exclusively for the treatment of malaria. It is not clear if women taking traditional medicine feel that they are already protected from malaria by the traditional medicine, or if they feel that taking SP would interfere with the traditional medicine they are taking for another reason. Women in Mali report using both traditional herbal remedies and modern medicine during pregnancy, and turning to traditional medicine when they cannot afford modern medicine (Hill et al. 2015). Encouragingly, almost none mentioned that they did not have confidence in treatment for malaria. (See **Figure 31**.)

Figure 31 Reasons given for not taking malaria medication during pregnancy (2015)



Note: among women who did not take any SP during pregnancy

4 CONCLUSIONS AND RECOMMENDATIONS

The Government of Mali has made substantial investments in recent years into malaria prevention and treatment. The NMCP, in coordination with its technical and financial partners, leads malaria control initiatives in the country, which include mass distribution of free ITNs, diagnosis and treatment of malaria, the free provision of IPTp with SP during pregnancy, seasonal malaria chemoprophylaxis, and targeted indoor residual spraying. Investments in social and behavior change, capacity building, and surveillance at health facilities and within the community support these major interventions.

This report examined trends in two key areas of malaria prevention: the provision and use of ITNs, and protection against malaria in pregnancy. Trends over the period 2006 to 2018 reflect the increased investment in these two areas. Although comparison of national trends is hampered by the exclusion of northern regions in 2012-13 and 2015, and the insecurity that affected sampling in Kidal in 2006, 2010, and 2018, the regional trends between surveys support an overall positive, significant improvement in coverage of ITNs and IPTp throughout the country.

Several indicators of ITN coverage have remained at or near target levels during the 2010-2018 period. Household ownership of at least one ITN was at least 80% since 2010 in all central and southern regions. Population access to ITN within the household has ranged from 55% to above 80% since 2010. This reflects the time elapsed between the previous mass distribution and the survey, and the rates of usage on nets. In Bamako, ITN access remains relatively high (although not at target levels) more than 3 years after the previous mass distribution of nets. This could justify not implementing any further ITN campaigns, given the very low prevalence and the recent WHO guidance on stratification. Continuing to strengthen routine ITN distribution and the commercial sector that provides quality ITNs would help ensure Bamako has access to ITNs when they need them. Nonetheless, continued mass campaigns are needed in other regions with products that are appropriate for the insecticide resistance profiles within the country. This would help to ensure that ITN access reaches above 80% and that population ITN use, in turn, could also achieve the 80% target in the National Strategic Plan 2018-22.

Population use of ITNs closely mirrors access, as demonstrated by the ITN use: access ratio, which has remained well above 80% since 2010 in all regions except Kidal. The percentage of nets used the previous night reinforces the fact that there is a strong culture of net use in Mali. This indicator also consistently exceeds 80% in all regions except Kidal. Given the seasonal patterns of malaria in Mali, and the fact that fieldwork for these surveys has occurred primarily in high transmission season since 2010, it is reassuring that people in Mali are using their available ITNs at high rates when the risk of malaria is also high. However, data from the 2006 DHS indicate that net use is markedly lower during the dry season. Research across different eco-geographical zones of West Africa suggests there is a strong reduction in overall use of ITNs by those with access in the dry season when mosquito presence is reduced (Koenker et al. 2019). It remains unclear how large the contribution of dry-season transmission is to the overall malaria burden in Mali. To accelerate progress towards the national targets, consistent use of ITNs throughout the year is crucial.

It is also reassuring that in households with some but insufficient numbers of ITNs, the most vulnerable groups—infants and pregnant women—are prioritized for net use. When households have insufficient nets,

a prioritization of some groups necessarily means a deprioritization of other groups. In this case, school-age and adult males are more exposed to malaria vectors. As households achieve full universal coverage, this gap reduces considerably but persists. This may be because school-age and adult males are, for cultural and/or reasons related to puberty, not able, are unwilling to share ITNs with other household members, perceive a lower risk, or a combination of reasons.

The IPTp3 coverage has significantly increased since 2006, just prior to the policy change, and has continued to increase with each survey. However, overall rates of IPTp3 remain below 30%. The gains in IPTp3 since 2012-13 appear to be due primarily to an increase in IPTp provision, rather than to increased ANC attendance, since ANC4 rates have not significantly changed since 2012-13 in any region. This suggests that the increased investments made into provider in-service training, refresher training, and supply chain management for SP may be responsible for the progress in IPTp3 rates. Additional gains are likely if ANC4 rates improve, along with early ANC attendance, which would give women more opportunities to receive doses of SP. However, there is significant work to be done with providers in order to meet the target of 80% of women receiving three doses of SP during pregnancy. Reducing the number of missed opportunities for SP during pregnancy will be essential. Although providers have the main responsibility and power to provide SP at ANC visits, continuing to improve awareness and understanding of the need for SP during pregnancy among women and their support networks is also essential.

There are clear disparities in ITN and IPTp coverage between the central/southern regions and the northern regions. Given the growing insecurity in these areas since 2012, implementation of malaria prevention activities has been challenging. In 2018, Tombouctou and Gao lagged behind the other regions in all indicators except the ITN use: access ratio, and nets used the previous night. Kidal lags behind on all indicators, although results must be used with caution since only urban areas were sampled in 2018.

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APPENDICES

Appendix Table 1 Plasmodium falciparum prevalence rate (via RDT) in children 6-59 months by background characteristics

Variable	2010		2012-13		2015		2018		Difference[2] '2012-13'-'2010'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	42.5 [35.7,49.6]		47.2 [44.3,50.2]		32.3 [27.9,37.0]		18.9 [16.5,21.7]		4.7	-14.8***	-10.1*	-13.4***	-28.3***	-23.6***
Sex				*										
Male	42.8 [35.8,50.2]		48.7 [45.5,52.0]		32.2 [28.1,36.6]		19.7 [16.8,22.9]		5.9	-16.5***	-10.6*	-12.6***	-29.1***	-23.2***
Female	42.2 [34.9,49.9]		45.6 [42.3,49.0]		32.4 [27.4,37.8]		18.2 [15.5,21.2]		3.4	-13.2***	-9.7*	-14.3***	-27.4***	-24.0***
Mother's Education				***		***		***						
None			51.0 [47.9,54.1]		35.9 [30.7,41.4]		22.0 [19.1,25.2]			-15.0***		-13.9***	-29.0***	
Primary			34.0 [28.0,40.4]		24.3 [20.0,29.3]		11.7 [8.6,15.7]			-9.5***		-12.7***	-22.2***	
Secondary +			15.2 [10.8,21.1]		11.1 [8.3,14.6]		7.9 [5.2,11.8]			-4.0*		-3.3***	-7.3***	
Wealth Quintile				***		***		***						
Lowest			64.0 [59.6,68.2]		49.9 [40.3,59.6]		31.2 [26.2,36.7]			-14.1***		-18.7	-32.8***	
Second			62.3 [57.8,66.5]		45.0 [39.8,50.4]		26.7 [22.6,31.2]			-17.2***		-18.4	-35.6***	
Middle			55.3 [50.8,59.7]		35.4 [30.8,40.3]		22.7 [18.9,26.9]			-19.9***		-12.8***	-32.7*	
Fourth			35.1 [29.5,41.1]		20.6 [15.3,27.1]		7.8 [5.4,11.2]			-14.5***		-12.8***	-27.3***	
Highest			10.3 [7.7,13.5]		4.4 [3.0,6.5]		1.3 [0.6,2.6]			-5.8***		-3.2***	-9.0***	
Place of Residence		***		***		***		***						
Urban	7.9 [4.1,14.6]		13.5 [10.6,16.9]		6.5 [4.8,8.8]		2.1 [1.1,3.9]		5.6	-6.9**	-1.3	-4.5**	-11.4***	-5.8**
Rural	50.0 [42.7,57.3]		54.9 [51.4,58.4]		38.4 [33.2,43.9]		23.1 [20.2,26.4]		4.9	-16.5***	-11.6*	-15.3***	-31.8***	-26.9***
Region		***		***		***		***						
Kayes	29.2 [14.1,51.0]		29.7 [23.6,36.7]		21.4 [12.3,34.6]		12.6 [7.9,19.5]		.5	-8.3	-7.8	-8.9	-17.2***	-16.7*
Koulikoro	44.0 [27.6,61.8]		45.5 [37.7,53.5]		31.6 [23.7,40.8]		21.7 [16.3,28.5]		1.5	-13.9*	-12.4	-9.9	-23.7***	-22.2**
Sikasso	66.8 [56.3,75.8]		59.5 [52.2,66.4]		44.3 [37.0,51.8]		29.7 [23.4,36.8]		-7.3	-15.2**	-22.5***	-14.6**	-29.8***	-37.1***
Segou	50.1 [33.4,66.7]		51.8 [46.1,57.5]		30.0 [21.4,40.4]		25.9 [19.0,34.3]		1.8	-21.8***	-20.0*	-4.1	-25.9***	-24.1**
Mopti	56.9 [43.3,69.5]		65.8 [59.7,71.4]		54.7 [39.5,69.0]		24.9 [16.2,36.2]		8.9	-11.1	-2.2	-29.8**	-40.9***	-32.0***
Bamako	2.1 [0.6,7.0]		6.2 [4.1,9.4]		2.7 [1.7,4.1]		2.9 [1.1,7.5]							
Tombouctou	21.8 [7.3,49.7]						15.3 [9.1,24.5]							-6.5***
Gao	21.3 [4.2,62.8]						1.6 [0.5,5.0]							-19.8**
Kidal	.9 [0.0,19.9]						.9 [0.3,2.4]							0.0

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 2 Anemia in children 6-59 months by background characteristics

Variable	2010		2012-13		2015		2018		Difference[2] '2012-13'-'2010'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	25.1 [21.4,29.1]		20.7 [19.1,22.5]		19.9 [17.5,22.6]		16.1 [14.5,17.8]		-4.3*	-.8	-5.1*	-3.8*	-4.6***	-9.0***
Sex				*				**						
Male	26.0 [21.6,31.0]		22.1 [20.1,24.3]		20.4 [17.9,23.0]		18.0 [15.9,20.3]		-3.9	-1.8	-5.7*	-2.4	-4.2*	-8.0**
Female	24.1 [20.0,28.7]		19.2 [17.2,21.4]		19.5 [16.6,22.7]		14.1 [12.2,16.2]		-4.9*	.2	-4.6	-5.4**	-5.1***	-10.0***
Mother's Education				***		***		**						
None			22.4 [20.5,24.3]		22.0 [19.1,25.2]		17.7 [15.7,20.0]			-.4**		-4.3***	-4.6***	
Primary			15.3 [11.8,19.7]		17.6 [14.4,21.3]		15.4 [12.0,19.7]			2.3		-2.2***	.1***	
Secondary +			8.7 [5.3,14.2]		9.9 [7.8,12.6]		9.7 [7.2,13.0]			1.2		-.2***	1.0***	
Wealth Quintile				***		***		***						
Lowest			28.0 [24.5,31.7]		27.8 [21.1,35.6]		22.3 [18.7,26.3]			-.2*		-5.5***	-5.7***	
Second			24.8 [21.8,28.0]		23.1 [20.4,26.1]		18.8 [15.7,22.3]			-1.6*		-4.3***	-6.0***	
Middle			22.1 [19.0,25.4]		23.3 [20.7,26.1]		17.1 [14.3,20.4]			1.2*		-6.1***	-4.9***	
Fourth			17.5 [14.0,21.7]		14.8 [12.0,18.1]		12.3 [9.8,15.2]			-2.7*		-2.5***	-5.2***	
Highest			8.3 [6.4,10.6]		7.9 [6.6,9.5]		7.8 [5.7,10.6]			-.3		-.1***	-.4***	
Place of Residence		***		***		***		***						
Urban	10.1 [7.4,13.7]		8.4 [6.7,10.6]		7.8 [6.5,9.4]		9.5 [7.4,12.1]		-1.7	-.6	-2.3	1.7	1.1	-.6
Rural	28.3 [24.2,32.9]		23.5 [21.5,25.6]		22.8 [19.9,25.9]		17.8 [15.8,19.8]		-4.8*	-.8	-5.6*	-5.0**	-5.8***	-10.6***
Region		**		***		**		***						
Kayes	31.6 [21.4,44.1]		19.1 [15.7,23.1]		19.6 [15.7,24.3]		18.8 [14.8,23.5]		-12.5*	.5	-12.0*	-.9	-.4	-12.9*
Koulikoro	21.1 [14.3,30.2]		20.5 [16.5,25.2]		19.8 [15.7,24.7]		21.5 [17.1,26.7]		-.6	-.7	-1.3	1.7	1.0	.4
Sikasso	34.6 [27.5,42.5]		21.2 [17.8,25.0]		19.5 [15.7,23.8]		15.1 [12.1,18.7]		-13.4***	-1.7	-15.1***	-4.4	-6.0*	-19.5***
Segou	28.8 [18.9,41.3]		20.7 [16.9,25.1]		20.4 [16.7,24.6]		15.8 [11.4,21.4]		-8.1	-.3	-8.4	-4.6	-4.9	-13.0*
Mopti	28.9 [20.7,38.6]		30.3 [25.3,35.8]		29.5 [19.5,42.0]		18.1 [12.8,24.9]		1.4	-.8	.7	-11.4	-12.2**	-10.8*
Bamako	7.4 [4.7,11.5]		8.3 [6.2,11.1]		7.6 [6.0,9.5]		10.1 [7.2,13.9]							
Tombouctou	16.4 [4.7,43.7]						10.0 [7.3,13.6]							-6.4
Gao	12.9 [5.9,25.7]						7.4 [4.2,12.9]							-5.4
Kidal	7.3 [0.9,39.4]						8.9 [6.6,12.1]							1.7

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 3 Household ownership of at least 1 ITN, by background characteristics for five surveys

Variable	2006		2010		2012-13		2015		2018		Difference[2] '2010'-'2006'	Difference[2] '2012-13'-'2010'	Difference[2] '2012-13'-'2006'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2015'-'2006'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'	Difference[2] '2018'-'2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]										
Total	50.0 [47.5,52.6]		85.9 [82.9,88.4]		84.4 [83.1,85.6]		93.0 [91.8,94.1]		89.8 [88.6,90.8]		35.9***	-1.5	34.3***	8.7***	7.1***	43.0***	-3.3***	5.4***	3.9**	39.7***
Head of Household's Education		**				***														
None	48.8 [45.5,52.0]				83.4 [81.9,84.8]				89.3 [87.9,90.6]				34.6***					5.9***		40.6***
Primary	52.3 [48.5,56.1]				88.2 [85.7,90.3]				92.3 [90.3,93.9]				35.9***					4.1**		40.0***
Secondary +	58.4 [53.0,63.7]				87.0 [84.5,89.1]				89.9 [87.6,91.8]				28.5***					2.9		31.5***
Wealth Quintile		***				***		*		**										
Lowest	51.6 [47.7,55.5]				79.8 [76.9,82.4]		94.1 [91.9,95.7]		91.9 [89.4,93.9]				28.2***	14.3***		42.5***	-2.1	12.1***		40.3***
Second	48.9 [45.3,52.5]				85.6 [83.5,87.6]		93.6 [91.0,95.5]		91.3 [89.5,92.8]				36.7***	8.0***		44.7***	-2.3	5.7***		42.4***
Middle	43.6 [40.1,47.1]				86.7 [84.6,88.6]		90.4 [87.1,92.9]		90.4 [88.3,92.2]				43.1***	3.7		46.8***	0.0	3.7*		46.8***
Fourth	49.5 [44.4,54.5]				86.3 [84.3,88.1]		92.2 [90.2,93.8]		89.1 [87.0,90.8]				36.8***	5.9***		42.7***	-3.1*	2.8*		39.6***
Highest	57.2 [53.8,60.6]				83.6 [81.2,85.7]		94.9 [92.6,96.4]		86.1 [83.4,88.5]				26.4***	11.3***		37.6***	-8.7***	2.6		28.9***
Place of Residence		*				*				***										
Urban	53.9 [49.5,58.2]		86.8 [83.1,89.9]		81.9 [79.6,83.9]		93.8 [91.6,95.5]		85.2 [82.9,87.2]		32.9***	-5.0*	28.0***	12.0***	7.0**	39.9***	-8.6***	3.3*	-1.6	31.3***
Rural	48.4 [45.4,51.3]		85.7 [81.9,88.7]		85.1 [83.6,86.4]		92.8 [91.3,94.1]		91.1 [89.7,92.3]		37.3***	-.6	36.7***	7.7***	7.1***	44.4***	-1.7	6.0***	5.4***	42.7***
Region		***				***		***		***										
Kayes	44.3 [36.7,52.2]		89.9 [79.6,95.3]		78.8 [74.7,82.4]		94.8 [90.7,97.1]		92.3 [89.7,94.4]		45.6***	-11.1*	34.5***	16.0***	4.9	50.5***	-2.4	13.5***	2.5	48.0***
Koulikoro	42.2 [36.7,47.9]		84.7 [77.6,89.9]		80.9 [77.8,83.6]		93.9 [89.1,96.7]		94.0 [91.2,96.0]		42.5***	-3.9	38.7***	13.0***	9.1**	51.7***	.1	13.1***	9.3***	51.8***
Sikasso	46.8 [42.4,51.2]		87.5 [80.1,92.4]		87.9 [85.5,90.0]		97.9 [96.3,98.8]		88.0 [85.4,90.2]		40.7***	.4	41.2***	9.9***	10.3***	51.1***	-9.8***	.1	.5	41.3***
Segou	50.3 [43.8,56.8]		87.0 [76.5,93.2]		92.0 [89.4,94.0]		88.8 [85.3,91.5]		90.1 [85.4,93.4]		36.7***	5.0	41.7***	-3.2	1.8	38.4***	1.3	-1.9	3.1	39.8***
Mopti	65.4 [60.2,70.3]		86.8 [77.2,92.7]		84.9 [80.2,88.6]		89.2 [85.5,92.0]		95.4 [92.6,97.1]		21.3***	-1.9	19.5***	4.3	2.4	23.8***	6.2**	10.5***	8.6**	30.0***
Bamako	54.2 [49.7,58.7]		86.4 [80.8,90.6]		77.3 [74.1,80.2]		94.2 [91.4,96.1]		83.8 [80.6,86.5]		32.2***	-9.1**	23.1***	16.9***	7.8***	40.0***	-10.4***	6.4**	-2.7	29.6***
Tombouctou	48.5 [41.8,55.3]		85.4 [67.1,94.4]						84.3 [77.7,89.2]		36.9***								-1.1	35.8***
Gao	45.0 [35.7,54.7]		66.0 [31.3,89.3]						73.6 [61.8,82.7]		21.0								7.6	28.6***
Kidal	28.7 [21.8,36.7]		55.1 [16.4,88.5]						21.3 [15.7,28.3]		26.4								-33.8*	-7.4

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 4 Household ownership of at least 1 ITN for 2 people, by background characteristics for five surveys

Variable	2006 % [C.I.]	p-value[1]	2010 % [C.I.]	p-value[1]	2012-13 % [C.I.]	p-value[1]	2015 % [C.I.]	p-value[1]	2018 % [C.I.]	p-value[1]	Difference[2] '2010'-'2006'	Difference[2] '2012-13'-'2010'	Difference[2] '2012-13'-'2006'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2015'-'2006'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'	Difference[2] '2018'-'2006'
Total	14.3 [12.9,15.7]		31.7 [28.1,35.4]		39.6 [38.0,41.2]		37.6 [35.3,40.0]		53.6 [51.8,55.3]		17.4***	7.9***	25.3***	-2.0	5.9**	23.4***	16.0***	14.0***	21.9***	39.3***
Head of Household's Education		**				***				**										
None	13.6 [12.1,15.3]				38.0 [36.1,39.9]				52.2 [50.2,54.1]				24.4***					14.2***		38.6***
Primary	14.2 [11.9,16.8]				39.6 [36.5,42.7]				54.7 [51.0,58.3]				25.3***					15.1***		40.5***
Secondary +	19.9 [16.7,23.5]				49.7 [46.4,52.9]				58.7 [55.2,62.2]				29.8***					9.1***		38.9***
Wealth Quintile		**				*		**												
Lowest	12.4 [10.1,15.1]				35.1 [31.8,38.5]		34.7 [30.2,39.4]		54.9 [51.7,58.0]				22.7***	-0.4		22.2***	20.2***	19.8***		42.4***
Second	12.0 [10.1,14.2]				39.2 [36.4,42.1]		33.8 [29.4,38.5]		54.2 [51.2,57.2]				27.2***	-5.4		21.8***	20.4***	15.0***		42.2***
Middle	11.5 [9.6,13.6]				41.0 [38.1,44.0]		35.2 [30.9,39.8]		56.1 [52.9,59.3]				29.6***	-5.8*		23.8***	20.9***	15.1***		44.7***
Fourth	17.0 [13.4,21.3]				40.5 [37.4,43.8]		37.8 [33.4,42.4]		52.0 [48.5,55.4]				23.5***	-2.7		20.8***	14.2***	11.5***		35.0***
Highest	18.1 [15.3,21.3]				42.3 [39.3,45.2]		45.0 [41.4,48.6]		50.7 [47.1,54.3]				24.1***	2.7		26.9***	5.7*	8.5***		32.6***
Place of Residence		**		*				*		***										
Urban	17.2 [15.2,19.3]		39.3 [32.5,46.6]		38.7 [35.9,41.6]		42.4 [38.4,46.5]		46.0 [42.5,49.6]		22.2***	-0.6	21.5***	3.7	3.1	25.2***	3.6	7.3**	6.7	28.9***
Rural	13.0 [11.4,14.7]		29.6 [25.7,33.9]		39.8 [37.9,41.7]		36.1 [33.4,39.0]		55.7 [53.7,57.7]		16.6***	10.2***	26.8***	-3.7*	6.5*	23.1***	19.6***	15.9***	26.1***	42.8***
Region		***				***		***		***										
Kayes	13.3 [9.6,18.3]		41.0 [31.1,51.7]		34.4 [30.6,38.5]		31.2 [25.4,37.7]		56.8 [52.9,60.7]		27.6***	-6.5	21.1***	-3.2	-9.7	17.9***	25.6***	22.4***	15.9**	43.5***
Koulikoro	9.1 [7.0,11.7]		29.2 [20.5,39.6]		35.1 [31.8,38.5]		38.5 [33.7,43.6]		61.4 [56.0,66.5]		20.1***	5.9	26.0***	3.5	9.4	29.5***	22.9***	26.3***	32.2***	52.4***
Sikasso	10.5 [8.3,13.1]		31.3 [22.0,42.4]		39.3 [35.6,43.1]		47.8 [41.5,54.2]		44.9 [41.3,48.6]		20.8***	8.0	28.8***	8.6*	16.5**	37.3***	-2.9	5.7*	13.6*	34.4***
Segou	15.1 [12.0,18.8]		26.4 [19.3,35.0]		51.6 [47.8,55.3]		31.7 [26.5,37.5]		59.9 [55.6,64.1]		11.3**	25.2***	36.5***	-19.9***	5.3	16.6***	28.2***	8.3**	33.5***	44.8***
Mopti	21.7 [17.6,26.5]		31.6 [22.3,42.5]		41.3 [37.1,45.7]		32.7 [27.1,38.8]		62.2 [57.5,66.7]		9.8	9.8	19.6***	-8.7*	1.1	10.9**	29.6***	20.9***	30.7***	40.5***
Bamako	16.1 [14.3,18.1]		37.5 [27.2,49.1]		32.3 [29.3,35.4]		42.8 [38.2,47.4]		39.4 [35.9,43.1]		21.4***	-5.2	16.1***	10.5***	5.3	26.6***	-3.3	7.2**	2.0	23.3***
Tombouctou	15.7 [12.4,19.8]		40.3 [29.2,52.4]						44.6 [38.6,50.7]		24.5***								4.3	28.8***
Gao	13.7 [9.2,19.8]		19.3 [7.1,42.5]						42.4 [30.1,55.9]		5.6								23.2*	28.8***
Kidal	5.5 [3.7,8.2]		8.0 [4.4,14.2]						8.7 [6.1,12.3]		2.5								.7	3.2

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 5 Population ITN access by background characteristics for five surveys

Variable	2006	p-value[1]	2010	p-value[1]	2012-13	p-value[1]	2015	p-value[1]	2018	p-value[1]	Difference[2] '2010'-'2006'	Difference[2] '2012-13'-'2010'	Difference[2] '2012-13'-'2006'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2015'-'2006'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'	Difference[2] '2018'-'2006'
Total	29.7 [27.9,31.5]		61.6 [58.6,64.7]		65.1 [63.7,66.4]		69.5 [67.9,71.2]		75.2 [73.8,76.6]		31.9***	3.5*	35.4***	4.4**	7.9***	39.8***	5.7***	10.1***	13.6***	45.5***
Head of Household's Education		***				***														
None	28.5 [26.5,30.5]				63.9 [62.3,65.5]				74.8 [73.3,76.3]				35.4***					10.9***		46.3***
Primary	30.7 [27.8,33.5]				67.0 [64.4,69.5]				76.7 [73.8,79.5]				36.3***					9.7***		46***
Secondary+	38.2 [34.3,42.0]				70.5 [68.0,73.0]				76.3 [73.5,79.1]				32.3***							38.1***
Wealth Quintile		***				***				***										
Lowest	28.2 [25.3,31.0]				60.3 [57.4,63.3]		67.6 [64.2,71.0]		78.6 [76.2,81.1]				32.1***	7.3**		39.4***	11.0***	18.3***		50.4***
Second	28.3 [25.5,31.2]				65.8 [63.4,68.2]		70.0 [67.0,73.1]		77.6 [75.5,79.8]				37.5***	4.2		41.7***	7.6***	11.8***		49.3***
Middle	26.1 [23.5,28.7]				67.5 [65.1,69.9]		68.0 [64.6,71.4]		77.2 [75.1,79.3]				41.4***	0.5		41.9***	9.2***	9.7***		51.1***
Fourth	30.1 [27.0,33.1]				66.6 [64.2,69.0]		69.4 [66.5,72.3]		74.0 [71.5,76.5]				36.5***	2.8		39.3***	4.6*	7.4***		43.9***
Highest	35.8 [32.8,38.9]				65.1 [62.6,67.6]		72.6 [69.6,75.6]		68.5 [65.7,71.4]				29.3***	7.5***		36.8***	-4.1*	3.4		32.7***
Place of Residence		*								***										
Urban	32.7 [30.6,34.7]		62.1 [57.3,67.0]		63.5 [60.9,66.0]		71.2 [68.7,73.7]		66.2 [63.5,69.0]		29.4***	1.4	30.8***	7.7***	9.1**	38.5***	-5.0*	2.7	4.1	33.5***
Rural	28.4 [26.1,30.8]		61.5 [57.8,65.2]		65.5 [63.9,67.1]		69.1 [67.0,71.1]		77.9 [76.4,79.5]		33.1***	4.0*	37.1***	3.6	7.6**	40.7***	8.8***	12.4***	16.4***	49.5***
Region		***		*		***		***		***										
Kayes	27.3 [20.8,33.9]		70.8 [62.8,78.8]		58.2 [54.4,62.0]		67.4 [64.3,70.4]		79.6 [77.2,82.1]		43.5***	-12.6**	30.9***	9.2**	-3.4	40.1***	12.2***	21.4***	8.8**	52.3***
Koulikoro	21.3 [17.8,24.8]		56.7 [48.0,65.4]		60.9 [57.7,64.1]		71.1 [66.9,75.3]		81.8 [78.3,85.3]		35.4***	4.2	39.6***	10.2**	14.4**	49.8***	10.7***	20.9***	25.1***	60.5***
Sikasso	25.5 [22.1,28.9]		61.1 [53.0,69.2]		66.8 [64.0,69.5]		77.9 [73.2,82.5]		71.1 [67.7,74.4]		35.6***	5.7	41.3***	11.1**	16.8***	52.4***	-6.8	4.3*	10.0**	45.6***
Segou	31.3 [26.1,36.6]		62.6 [55.7,69.5]		76.5 [73.5,79.6]		63.0 [59.6,66.4]		79.3 [75.6,82.9]		31.3***	13.9***	45.2***	-13.5***	0.4	31.7***	16.3***	2.8	16.7***	48***
Mopti	40.9 [35.8,46.0]		65.3 [57.0.6,73]		65.9 [61.4,70.3]		66.1 [61.6,70.6]		83.0 [79.3,86.6]		24.4***	0.6	25***	0.2	0.8	25.2***	16.9***	17.1***	17.7***	42.1***
Bamako	34.1 [30.9,37.4]		60.1 [52.8,67.3]		56.7 [53.6,59.9]		71.3 [67.8,74.8]		61.5 [58.5,64.5]		26***	-3.4	22.6***	14.6***	11.2**	37.2***	-9.8***	4.8	1.4	27.4***
Tombouctou	31.1 [25.6,36.7]		64.1 [48.0,80.3]						68.1 [63.5,72.7]		33***								4	37***
Gao	28.1 [21.4,34.8]		44.5 [16.6,72.4]						62.4 [52.1,72.7]		16.4								17.9	34.3***
Kidal	14.7 [10.0,19.4]		27.6 [4.0,51.1]						15.3 [9.5,21.2]		12.9*								-12.3	0.6

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 6 Population ITN use by background characteristics for five surveys

Variable	2006		2010		2012-13		2015		2018		Difference² '2010'-'2006'	Difference² '2012-13'-'2010'	Difference² '2012-13'-'2006'	Difference² '2015'-'2012-13'	Difference² '2015'-'2010'	Difference² '2015'-'2006'	Difference² '2018'-'2015'	Difference² '2018'-'2012-13'	Difference² '2018'-'2010'	Difference² '2018'-'2006'
	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹										
Total	21.4 [19.8,23.2]		56.2 [53.2,59.2]		60.5 [59.0,62.0]		63.9 [62.0,65.8]		72.9 [71.6,74.3]		34.8***	4.3*	39.1***	3.4**	7.7***	42.4***	9.0***	12.4***	16.7***	51.5***
Head of Household's Education		***				**														
None	20.6 [18.7,22.6]				59.6 [57.9,61.2]				73.1 [71.7,74.6]				39.0***					13.6***		52.6***
Primary	21.6 [19.3,24.2]				63.5 [60.6,66.3]				75.3 [72.3,78.1]				41.9***					11.8***		53.7***
Secondary +	28.3 [25.2,31.7]				63.6 [61.0,66.2]				70.9 [68.0,73.6]				35.3***					7.3***		42.6***
Wealth Quintile		**				***				***										
Lowest	20.1 [17.4,23.0]				56.3 [53.3,59.2]		63.0 [59.8,66.1]		77.8 [75.4,80.0]				36.2***	6.7**		42.9***	14.8***	21.5***		57.7***
Second	20.7 [18.2,23.5]				60.9 [58.3,63.4]		66.2 [62.9,69.4]		76.9 [75.0,78.7]				40.2***	5.3*		45.5***	10.7***	16.0***		56.2***
Middle	18.8 [16.5,21.3]				63.1 [60.8,65.4]		62.1 [58.7,65.4]		75.3 [72.8,77.6]				44.3***	-1.0		43.3***	13.2***	12.2***		56.5***
Fourth	21.5 [19.2,23.9]				63.2 [61.0,65.5]		65.4 [61.6,69.0]		72.6 [70.2,74.9]				41.8***	2.1		43.9***	7.2***	9.4***		51.2***
Highest	26.2 [23.0,29.6]				59.0 [56.3,61.7]		62.8 [59.2,66.3]		62.1 [59.2,65.0]				32.9***	3.8		36.6***	-0.7	3.1		36.0***
Place of Residence										***										
Urban	23.1 [20.8,25.6]		55.0 [50.1,59.8]		58.4 [55.8,61.1]		61.4 [58.4,64.4]		61.3 [58.4,64.1]		31.9***	3.5	35.4***	3.0	6.5*	38.3***	-0.2	2.8	6.3*	38.2***
Rural	20.7 [18.5,23.1]		56.6 [52.9,60.2]		61.1 [59.3,62.8]		64.6 [62.3,66.9]		76.5 [75.0,77.9]		35.8***	4.5*	40.4***	3.5*	8.0***	43.9***	11.9***	15.4***	19.9***	55.8***
Region		**		*		***		**		***										
Kayes	19.8 [14.0,27.3]		62.0 [54.9,68.7]		53.2 [49.3,57.1]		63.7 [59.2,68.1]		79.1 [76.5,81.4]		42.2***	-8.8*	33.4***	10.5***	1.7	43.9***	15.4***	25.8***	17.1***	59.3***
Koulikoro	14.7 [11.8,18.2]		49.6 [41.9,57.3]		56.2 [52.8,59.5]		66.0 [60.8,70.8]		77.9 [74.6,81.0]		34.9***	6.6	41.5***	9.8**	16.4***	51.3***	12.0***	21.8***	28.3***	63.2***
Sikasso	20.1 [17.1,23.5]		58.9 [52.9,64.6]		62.6 [59.6,65.6]		71.3 [65.6,76.4]		69.7 [66.4,72.9]		38.8***	3.8	42.6***	8.7**	12.5**	51.2***	-1.6	7.1**	10.9***	49.7***
Segou	22.7 [18.0,28.2]		58.9 [50.7,66.5]		72.6 [69.5,75.5]		58.1 [53.8,62.2]		78.5 [74.9,81.7]		36.1***	13.7***	49.9***	-14.5***	-0.8	35.3***	20.4***	5.9*	19.6***	55.7***
Mopti	27.6 [21.0,35.3]		62.3 [53.7,70.2]		60.9 [56.2,65.4]		64.1 [59.6,68.3]		81.7 [78.6,84.5]		34.7***	-1.4	33.3***	3.2	1.8	36.5***	17.7***	20.9***	19.4***	54.1***
Bamako	25.1 [22.1,28.3]		50.9 [45.3,56.6]		51.6 [48.2,55.0]		59.0 [55.1,62.9]		55.5 [52.2,58.8]		25.9***	0.7	26.5***	7.4**	8.1*	34.0***	-3.5	3.9	4.6	30.4***
Tombouctou	26.4 [21.7,31.8]		55.1 [41.4,68.0]						66.2 [61.4,70.7]		28.6***								11.1	39.8***
Gao	17.3 [13.2,22.5]		46.9 [18.6,77.2]						63.4 [53.6,72.2]		29.5*								16.6	46.1***
Kidal	1.5 [0.4,5.6]		16.4 [2.3,62.1]						13.3 [11.1,16.0]		15.0**								-3.1	11.9***

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 7 ITN use:access ratio by background characteristics for five surveys

Variable	2006 ratio	2010 ratio	2012-13 ratio	2015 ratio	2018 ratio	Difference '2010'-'2006'	Difference '2012-13'-'2010'	Difference '2012-13'-'2006'	Difference '2015'-'2012-13'	Difference '2015'-'2010'	Difference '2015'-'2006'	Difference '2018'-'2015'	Difference '2018'-'2012-13'	Difference '2018'-'2010'	Difference '2018'-'2006'
Total	0.72	0.91	0.93	0.92	0.97	0.19	0.02	0.21	-0.01	0.01	0.20	0.05	0.04	0.06	0.25
Head of Household's Education															
None	0.72		0.93		0.98			0.21					0.05		0.26
Primary	0.71		0.95		0.98			0.24					0.03		0.27
Secondary+	0.74		0.90		0.93			0.16					0.03		0.19
Wealth Quintile															
Lowest	0.71		0.93	0.93	0.99			0.22	0.00		0.22	0.06	0.06		0.28
Second	0.73		0.93	0.95	0.99			0.20	0.02		0.22	0.04	0.06		0.26
Middle	0.72		0.93	0.91	0.98			0.21	-0.02		0.19	0.07	0.05		0.26
Fourth	0.71		0.95	0.94	0.98			0.24	-0.01		0.23	0.04	0.03		0.27
Highest	0.73		0.91	0.87	0.91			0.18	-0.04		0.14	0.04	0.00		0.18
Place of Residence															
Urban	0.71	0.88	0.92	0.86	0.93	0.17	0.04	0.21	-0.06	-0.02	0.15	0.07	0.01	0.05	0.22
Rural	0.73	0.92	0.93	0.94	0.98	0.19	0.01	0.20	0.01	0.02	0.21	0.04	0.05	0.06	0.25
Region															
Kayes	0.73	0.88	0.91	0.95	0.99	0.15	0.03	0.18	0.04	0.07	0.22	0.04	0.08	0.11	0.26
Koulikoro	0.69	0.88	0.92	0.93	0.95	0.19	0.04	0.23	0.01	0.05	0.24	0.02	0.03	0.07	0.26
Sikasso	0.79	0.96	0.94	0.92	0.98	0.17	-0.02	0.15	-0.02	-0.04	0.13	0.06	0.04	0.02	0.19
Segou	0.73	0.94	0.95	0.92	0.99	0.21	0.01	0.22	-0.03	-0.02	0.19	0.07	0.04	0.05	0.26
Mopti	0.68	0.95	0.92	0.97	0.99	0.27	-0.03	0.24	0.05	0.02	0.29	0.02	0.07	0.04	0.31
Bamako	0.74	0.85	0.91	0.83	0.90	0.11	0.06	0.17	-0.08	-0.02	0.09	0.07	-0.01	0.05	0.16
Tombouctou	0.85	0.86			0.97	0.01								0.11	0.12
Gao	0.62	1.05			1.02	0.43								-0.03	0.40
Kidal	0.10	0.60			0.87	0.50								0.27	0.77

Appendix Table 8 Percent of nets used the previous night, by background characteristics for five surveys

Variable	2006		2010		2012-13		2015		2018		Difference² '2010'-'2006'	Difference² '2012-13'-'2010'	Difference² '2012-13'-'2006'	Difference² '2015'-'2012-13'	Difference² '2015'-'2010'	Difference² '2015'-'2006'	Difference² '2018'-'2015'	Difference² '2018'-'2012-13'	Difference² '2018'-'2010'	Difference² '2018'-'2006'
	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹										
Total	72.3 [68.8,75.6]		87.1 [85.1,88.9]		88.9 [87.9,89.9]		98.3 [97.9,98.7]		88.9 [88.1,89.6]		14.7***	1.9	16.6***	9.4***	11.3***	26.0***	-9.5***	-0.1	1.8	16.5***
Head of Household's Education										***										
None	72.1 [67.9,76.0]				88.8 [87.6,89.8]				90.3 [89.5,91.2]				16.7***					1.6*		18.2***
Primary	69.7 [64.9,74.2]				89.6 [87.5,91.3]				88.1 [86.4,89.6]				19.9***					-1.5		18.4***
Secondary +	76.3 [71.4,80.6]				89.2 [87.3,91.0]				83.7 [81.6,85.6]				12.9***					-5.5***		7.4**
Wealth Quintile										***										
Lowest	72.7 [68.3,76.6]				88.3 [86.0,90.3]		98.6 [97.2,99.2]		89.8 [88.0,91.2]				15.7***	10.2***		25.9***	-8.8***	1.4		17.1***
Second	74.3 [70.1,78.2]				88.6 [86.8,90.2]		98.4 [97.7,98.9]		90.6 [89.3,91.8]				14.3***	9.8***		24.1***	-7.8***	2.0		16.3***
Middle	72.7 [68.1,76.8]				88.7 [86.9,90.3]		98.4 [97.8,98.9]		89.8 [88.4,91.1]				16.0***	9.8***		25.8***	-8.6***	1.2		17.1***
Fourth	70.5 [66.6,74.1]				89.3 [87.6,90.9]		98.3 [97.7,98.8]		88.5 [87.0,89.8]				18.8***	9.0***		27.8***	-9.8***	-0.8		18.0***
Highest	71.7 [63.5,78.7]				89.8 [88.1,91.2]		98.0 [97.0,98.6]		85.4 [83.2,87.4]				18.0***	8.2***		26.3***	-12.6***	-4.3***		13.7***
Place of Residence						**		*		*										
Urban	70.7 [63.1,77.4]		87.2 [84.0,89.8]		90.9 [89.4,92.2]		97.8 [96.9,98.4]		87.1 [85.1,88.9]		16.5***	3.7*	20.2***	6.9***	10.6***	27.0***	-10.6***	-3.8**	-0.1	16.4***
Rural	73.1 [69.4,76.5]		87.1 [84.6,89.2]		88.4 [87.2,89.6]		98.5 [98.0,98.9]		89.3 [88.5,90.1]		14.0***	1.4	15.3***	10.1***	11.4***	25.4***	-9.2***	0.9	2.3*	16.2***
Region				**		***				***										
Kayes	71.8 [63.0,79.2]		83.7 [72.1,91.0]		84.0 [81.1,86.5]		98.6 [97.8,99.0]		88.9 [87.5,90.2]		11.9	0.3	12.2**	14.6***	14.9***	26.8***	-9.6***	4.9***	5.3	17.2***
Koulikoro	71.1 [63.6,77.5]		85.3 [80.1,89.3]		86.8 [83.6,89.4]		98.5 [97.5,99.1]		85.3 [83.5,87.0]		14.2***	1.5	15.7***	11.8***	13.2***	27.5***	-13.2***	-1.4	0.1	14.3***
Sikasso	79.5 [75.1,83.2]		94.5 [91.9,96.3]		91.3 [89.3,93.0]		97.9 [96.3,98.9]		93.5 [91.6,94.9]		15.0***	-3.2*	11.8***	6.6***	3.4**	18.5***	-4.5***	2.2	-1.0	14.0***
Segou	72.8 [64.3,79.9]		88.8 [84.4,92.1]		92.0 [90.3,93.3]		98.7 [98.1,99.1]		91.9 [90.2,93.3]		16.0***	3.2	19.2***	6.8***	9.9***	25.9***	-6.9***	-0.1	3.1	19.1***
Mopti	66.5 [54.8,76.4]		87.7 [83.8,90.8]		87.1 [83.4,90.1]		98.9 [98.0,99.4]		85.9 [83.2,88.3]		21.2***	-0.6	20.7***	11.8***	11.2***	32.5***	-13.0***	-1.2	-1.8	19.5***
Bamako	74.1 [68.6,78.9]		85.1 [80.0,89.1]		89.0 [86.8,90.9]		97.3 [95.9,98.2]		86.4 [83.2,89.1]		11.0**	3.9	15.0***	8.2***	12.2***	23.2***	-10.8***	-2.6	1.3	12.3***
Tombouctou	82.9 [77.2,87.4]		78.6 [68.7,86.0]						92.4 [90.7,93.8]		-4.3								13.8***	9.5***
Gao	64.0 [47.9,77.5]		88.0 [66.0,96.5]						92.5 [89.4,94.7]		24.0*								4.5	28.4***
Kidal	13.2 [4.1,34.9]		42.2 [11.1,81.0]						74.2 [55.3,87.0]		29.0								31.9	61.0***

Notes: *p<0.05, **p<0.01, ***p<0.001
1 p-value significance of the covariate in each survey
2 Difference between the two surveys with the p-value of the difference.

Appendix Table 9 Percent of nets used the previous night, by background characteristics for five surveys

Variable	2006		2010		2012-13		2015		2018		Difference² '2010'-'2006'	Difference² '2012-13'-'2010'	Difference² '2012-13'-'2006'	Difference² '2015'-'2012-13'	Difference² '2015'-'2010'	Difference² '2015'-'2006'	Difference² '2018'-'2015'	Difference² '2018'-'2012-13'	Difference² '2018'-'2010'	Difference² '2018'-'2006'
	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹										
Total	72.3 [68.8,75.6]		87.1 [85.1,88.9]		88.9 [87.9,89.9]		98.3 [97.9,98.7]		88.9 [88.1,89.6]		14.7***	1.9	16.6***	9.4***	11.3***	26.0***	-9.5***	-0.1	1.8	16.5***
Head of Household's Education										***										
None	72.1 [67.9,76.0]				88.8 [87.6,89.8]				90.3 [89.5,91.2]				16.7***					1.6*		18.2***
Primary	69.7 [64.9,74.2]				89.6 [87.5,91.3]				88.1 [86.4,89.6]				19.9***					-1.5		18.4***
Secondary +	76.3 [71.4,80.6]				89.2 [87.3,91.0]				83.7 [81.6,85.6]				12.9***					-5.5***		7.4**
Wealth Quintile										***										
Lowest	72.7 [68.3,76.6]				88.3 [86.0,90.3]		98.6 [97.2,99.2]		89.8 [88.0,91.2]				15.7***	10.2***		25.9***	-8.8***	1.4		17.1***
Second	74.3 [70.1,78.2]				88.6 [86.8,90.2]		98.4 [97.7,98.9]		90.6 [89.3,91.8]				14.3***	9.8***		24.1***	-7.8***	2.0		16.3***
Middle	72.7 [68.1,76.8]				88.7 [86.9,90.3]		98.4 [97.8,98.9]		89.8 [88.4,91.1]				16.0***	9.8***		25.8***	-8.6***	1.2		17.1***
Fourth	70.5 [66.6,74.1]				89.3 [87.6,90.9]		98.3 [97.7,98.8]		88.5 [87.0,89.8]				18.8***	9.0***		27.8***	-9.8***	-0.8		18.0***
Highest	71.7 [63.5,78.7]				89.8 [88.1,91.2]		98.0 [97.0,98.6]		85.4 [83.2,87.4]				18.0***	8.2***		26.3***	-12.6***	-4.3***		13.7***
Place of Residence						**		*		*										
Urban	70.7 [63.1,77.4]		87.2 [84.0,89.8]		90.9 [89.4,92.2]		97.8 [96.9,98.4]		87.1 [85.1,88.9]		16.5***	3.7*	20.2***	6.9***	10.6***	27.0***	-10.6***	-3.8**	-0.1	16.4***
Rural	73.1 [69.4,76.5]		87.1 [84.6,89.2]		88.4 [87.2,89.6]		98.5 [98.0,98.9]		89.3 [88.5,90.1]		14.0***	1.4	15.3***	10.1***	11.4***	25.4***	-9.2***	0.9	2.3*	16.2***
Region				**		***				***										
Kayes	71.8 [63.0,79.2]		83.7 [72.1,91.0]		84.0 [81.1,86.5]		98.6 [97.8,99.0]		88.9 [87.5,90.2]		11.9	0.3	12.2**	14.6***	14.9***	26.8***	-9.6***	4.9***	5.3	17.2***
Koulikoro	71.1 [63.6,77.5]		85.3 [80.1,89.3]		86.8 [83.6,89.4]		98.5 [97.5,99.1]		85.3 [83.5,87.0]		14.2***	1.5	15.7***	11.8***	13.2***	27.5***	-13.2***	-1.4	0.1	14.3***
Sikasso	79.5 [75.1,83.2]		94.5 [91.9,96.3]		91.3 [89.3,93.0]		97.9 [96.3,98.9]		93.5 [91.6,94.9]		15.0***	-3.2*	11.8***	6.6***	3.4**	18.5***	-4.5***	2.2	-1.0	14.0***
Segou	72.8 [64.3,79.9]		88.8 [84.4,92.1]		92.0 [90.3,93.3]		98.7 [98.1,99.1]		91.9 [90.2,93.3]		16.0***	3.2	19.2***	6.8***	9.9***	25.9***	-6.9***	-0.1	3.1	19.1***
Mopti	66.5 [54.8,76.4]		87.7 [83.8,90.8]		87.1 [83.4,90.1]		98.9 [98.0,99.4]		85.9 [83.2,88.3]		21.2***	-0.6	20.7***	11.8***	11.2***	32.5***	-13.0***	-1.2	-1.8	19.5***
Bamako	74.1 [68.6,78.9]		85.1 [80.0,89.1]		89.0 [86.8,90.9]		97.3 [95.9,98.2]		86.4 [83.2,89.1]		11.0**	3.9	15.0***	8.2***	12.2***	23.2***	-10.8***	-2.6	1.3	12.3***
Tombouctou	82.9 [77.2,87.4]		78.6 [68.7,86.0]						92.4 [90.7,93.8]		-4.3								13.8***	9.5***
Gao	64.0 [47.9,77.5]		88.0 [66.0,96.5]						92.5 [89.4,94.7]		24.0*								4.5	28.4***
Kidal	13.2 [4.1,34.9]		42.2 [11.1,81.0]						74.2 [55.3,87.0]		29.0								31.9	61.0***

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 10 ITN use by children under 5 by background characteristics for five surveys

Variable	2006		2010		2012-13		2015		2018		Difference² '2010'-'2006'	Difference² '2012-13'-'2010'	Difference² '2012-13'-'2006'	Difference² '2015'-'2012-13'	Difference² '2015'-'2010'	Difference² '2015'-'2006'	Difference² '2018'-'2015'	Difference² '2018'-'2012-13'	Difference² '2018'-'2010'	Difference² '2018'-'2006'
	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹										
Total	27.2 [24.9,29.6]		71.4 [67.3,75.1]		69.1 [67.3,70.8]		71.2 [68.9,73.4]		79.2 [77.7,80.6]		44.2***	-2.3	41.9***	2.1	-0.2	44.0***	8.0***	10.1***	7.8***	52.0***
Mother's Education		**								***										
None	26.9 [24.5,29.5]				70.0 [67.6,72.3]		73.0 [70.6,75.2]		80.8 [79.2,82.2]				43.1***	3.0		46.1***	7.8***	10.8		53.9***
Primary	31.9 [28.2,35.8]				76.3 [71.5,80.4]		71.6 [66.3,76.3]		82.3 [79.2,85.0]				44.4***	-4.7		39.7***	10.8***	6.1		50.4***
Secondary +	33.9 [29.6,38.5]				72.5 [66.3,77.9]		70.2 [64.4,75.4]		74.7 [70.5,78.5]				38.6***	-2.3		36.3***	4.6	2.2		40.8***
Wealth Quintile		**				**				***										
Lowest	26.0 [22.5,29.9]				65.9 [62.4,69.3]		68.5 [64.6,72.2]		83.0 [80.4,85.2]				39.9***	2.6		42.5***	14.5***	17.0***		56.9***
Second	26.4 [23.0,30.0]				67.8 [64.3,71.1]		72.3 [68.5,75.9]		81.1 [78.6,83.3]				41.4***	4.6		46.0***	8.7***	13.3***		54.7***
Middle	24.4 [21.3,27.7]				70.0 [67.2,72.8]		71.0 [66.7,75.0]		82.6 [80.1,84.9]				45.7***	1.0		46.7***	11.6***	12.6***		58.3***
Fourth	26.0 [22.5,29.9]				73.3 [70.4,75.9]		73.7 [69.4,77.6]		79.0 [76.1,81.7]				47.2***	0.4		47.7***	5.3*	5.8**		53.0***
Highest	33.9 [29.0,39.2]				68.3 [65.3,71.2]		70.1 [65.2,74.6]		68.1 [63.5,72.4]				34.4***	1.8		36.2***	-2.0	-0.2		34.2***
Place of Residence										***										
Urban	29.4 [24.6,34.6]		67.4 [60.7,73.4]		67.7 [64.4,70.8]		67.9 [64.0,71.7]		67.8 [63.7,71.7]		38.0***	0.3	38.3***	0.2	0.5	38.6***	-0.1	0.1	0.4	38.5***
Rural	26.3 [23.8,29.1]		72.3 [67.4,76.7]		69.4 [67.4,71.3]		71.9 [69.2,74.5]		82.1 [80.6,83.5]		45.9***	-2.9	43.1***	2.5	-0.3	45.6***	10.1***	12.7***	9.8***	55.7***
Region						***				***										
Kayes	26.9 [19.5,35.9]		77.8 [69.9,84.2]		63.0 [58.5,67.2]		72.5 [66.5,77.7]		85.2 [82.4,87.5]		50.9***	-14.9***	36.0***	9.5**	-5.4	45.5***	12.7***	22.2***	7.3*	58.2***
Koulikoro	22.0 [17.7,27.2]		68.9 [57.3,78.5]		66.7 [62.0,71.1]		72.8 [65.8,78.8]		83.2 [79.8,86.2]		46.9***	-2.2	44.7***	6.1	3.9	50.7***	10.4**	16.5***	14.3**	61.2***
Sikasso	26.1 [22.0,30.5]		77.2 [69.8,83.1]		70.9 [67.1,74.5]		74.3 [67.4,80.2]		76.2 [72.7,79.4]		51.1***	-6.3	44.8***	3.4	-2.8	48.3***	1.9	5.3*	-1.0	50.1***
Segou	27.3 [22.2,33.2]		72.0 [58.9,82.1]		77.8 [74.5,80.7]		67.9 [63.2,72.2]		83.8 [79.7,87.1]		44.6***	5.8	50.5***	-9.9***	-4.1	40.5***	15.9***	6.0*	11.8*	56.4***
Mopti	30.8 [21.4,42.1]		74.5 [61.9,84.1]		67.0 [61.9,71.7]		72.5 [67.1,77.3]		86.2 [82.2,89.5]		43.8***	-7.6	36.2***	5.5	-2.1	41.7***	13.7***	19.2***	11.7*	55.5***
Bamako	33.0 [27.6,39.0]		66.0 [58.9,72.4]		63.9 [60.3,67.4]		64.9 [60.0,69.4]		63.7 [58.2,68.9]		32.9***	-2.1	30.9***	1.0	-1.1	31.8***	-1.2	-0.2	-2.3	30.7***
Tombouctou	33.2 [26.6,40.6]		64.3 [44.9,79.9]						75.7 [70.9,80.0]		31.1***								11.4	42.5***
Gao	22.8 [16.2,31.2]		58.6 [26.0,85.1]						65.7 [55.0,75.0]		35.7**								7.1	42.9***
Kidal	2.3 [0.5,9.0]		24.5 [2.7,79.0]						21.0 [16.6,26.2]		22.2*								-3.5	18.8***

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 11 ITN use by children under 5 in households owning at least 1 ITN, by background characteristics for five surveys

Variable	2006	p-value[1]	2010	p-value[1]	2012-13	p-value[1]	2015	p-value[1]	2018	p-value[1]	Difference[2] '2010'-'2006'	Difference[2] '2012-13'-'2010'	Difference[2] '2012-13'-'2006'	Difference[2] '2015'-'2012-13'	Difference[2] '2015'-'2010'	Difference[2] '2015'-'2006'	Difference[2] '2018'-'2015'	Difference[2] '2018'-'2012-13'	Difference[2] '2018'-'2010'	Difference[2] '2018'-'2006'
Total	50.3 [46.9,53.7]		77.3 [73.6,80.7]		78.1 [76.7,79.5]		75.2 [72.9,77.3]		85.5 [84.2,86.6]		27.0***	0.8	27.8***	-2.9*	-2.1	24.9***	10.3***	7.4***	8.2***	35.1***
Mother's Education										***										
None	50.7 [47.2,54.3]				79.3 [77.3,81.3]		76.8 [74.5,79.0]		87.0 [85.8,88.0]				28.6***	-2.5		26.1***	10.1***	7.6		36.2***
Primary	54.3 [48.8,59.6]				82.5 [78.3,85.1]		74.9 [69.7,79.5]		87.6 [84.9,89.9]				28.3***	-7.6*		20.7***	12.7***	5.1*		33.4***
Secondary +	52.1 [45.8,54.4]				82.6 [77.7,86.6]		73.9 [74.0,79.3]		81.0 [76.7,84.7]				30.5***	-8.7*		21.8***	7.1*	-1.6*		28.9***
Wealth Quintile										***										
Lowest	47.7 [42.9,52.6]				78.2 [75.1,81.0]		72.6 [68.9,76.1]		88.0 [86.1,89.8]				30.5***	-5.6*		24.9***	15.4***	9.9***		40.3***
Second	51.6 [46.9,56.3]				75.7 [72.4,78.8]		75.7 [71.9,79.2]		86.8 [84.5,88.7]				24.1***	0.0		24.1***	11.0***	11.0***		35.1***
Middle	48.9 [44.2,53.6]				78.2 [75.5,80.7]		76.2 [71.6,80.2]		88.4 [86.1,90.3]				29.4***	-2.1		27.3***	12.2***	10.2***		39.5***
Fourth	51.2 [46.3,56.0]				80.3 [77.6,82.7]		77.8 [73.8,81.3]		86.1 [83.3,88.4]				29.1***	-2.5		26.6***	8.3***	5.8**		34.9***
Highest	52.1 [44.2,59.9]				78.1 [75.5,80.6]		73.4 [68.2,77.9]		75.9 [71.1,80.2]				26.0***	-4.8		21.2***	2.6	-2.2		23.8***
Place of Residence										***										
Urban	50.1 [42.1,58.0]		75.1 [69.2,80.1]		78.2 [75.5,80.8]		71.6 [67.3,75.6]		76.1 [71.7,79.9]		25.0***	3.2	28.2***	-6.6**	-3.4	21.6***	4.4	-2.2	1.0	26.0***
Rural	50.4 [47.1,53.7]		77.8 [73.3,81.7]		78.1 [76.4,79.6]		76.0 [73.3,78.5]		87.7 [86.6,88.8]		27.4***	0.3	27.7***	-2.0	-1.8	25.6***	11.7***	9.7***	9.9***	37.3***
Region						*				***										
Kayes	55.9 [46.3,65.1]		80.4 [74.8,85.1]		75.5 [71.8,78.9]		75.3 [70.4,79.7]		89.8 [87.7,91.6]		24.5***	-4.9	19.6***	-0.2	-5.1	19.4***	14.5***	14.3***	9.4***	33.9***
Koulikoro	48.1 [41.8,54.4]		76.0 [67.1,83.2]		77.8 [73.8,81.3]		76.6 [69.7,82.3]		86.7 [83.4,89.5]		28.0***	1.7	29.7***	-1.2	0.6	28.5***	10.1**	9.0***	10.7**	38.7***
Sikasso	50.7 [45.6,55.8]		82.5 [76.2,87.4]		78.5 [75.1,81.4]		75.3 [68.2,81.3]		83.5 [81.1,85.6]		31.8***	-4.0	27.7***	-3.1	-7.2	24.6***	8.2**	5.0**	1.0	32.8***
Segou	47.3 [39.5,55.2]		75.7 [63.1,85.1]		82.5 [79.6,85.0]		74.8 [69.7,79.3]		91.5 [88.9,93.6]		28.4***	6.8	35.2***	-7.7**	-0.9	27.5***	16.7***	9.0***	15.8***	44.2***
Mopti	45.8 [33.5,58.7]		78.1 [63.6,87.9]		75.1 [71.1,78.8]		78.9 [73.7,83.3]		89.5 [86.4,92.0]		32.2***	-2.9	29.3***	3.8	0.9	33.1***	10.6***	14.3***	11.4*	43.6***
Bamako	53.8 [47.1,60.5]		73.6 [65.8,80.2]		75.9 [72.6,78.9]		67.9 [63.0,72.4]		71.6 [65.7,76.9]		19.8***	2.3	22.1***	-8.0**	-5.7	14.0***	3.7	-4.3	-2.0	17.8***
Tombouctou	65.8 [58.3,72.6]		74.4 [59.0,85.4]						82.1 [77.5,85.9]		8.6								7.7	16.3***
Gao	46.2 [35.2,57.5]		80.5 [49.9,94.5]						81.6 [73.7,87.5]		34.3*								1.1	35.4***
Kidal	6.4 [1.7,21.8]		40.9 [11.9,78.1]						65.3 [47.5,79.7]		34.5**								24.4	58.9***

Notes: *p<0.05, **p<0.01, ***p<0.001

[1] p-value significance of the covariate in each survey

[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 12 ITN use by pregnant women, by background characteristics for four surveys

Variable	2006		2012-13		2015		2018		Difference² '2012-13'- '2006'	Difference² '2015'- '2012-13'	Difference² '2015'- '2006'	Difference² '2018'- '2015'	Difference² '2018'- '2012-13'	Difference² '2018'- '2006'
	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹	% [C.I.]	p-value¹						
Total	28.9 [25.0,33.2]		73.2 [69.6,76.5]		77.9 [74.4,81.0]		83.7 [80.6,86.4]		44.3***	4.7	48.9***	5.8**	10.5***	54.8***
Woman's Education														
None	28.8 [24.6,33.5]				70.2 [64.9,71.9]		83.4 [78.5,87.4]		41.4***				13.3***	54.6***
Primary	23.6 [16.9,31.8]				75.9 [63.1,85.3]		85.0 [73.9,91.9]		52.4***				9.1	61.4***
Secondary +	44.2 [32.1,56.9]				71.6 [56.9,82.9]		79.6 [69.3,87.0]		27.5**				7.9	35.4***
Wealth Quintile								**						
Lowest	28.5 [23.4,34.3]		68.7 [61.3,75.3]		78.4 [70.8,84.4]		86.0 [79.6,90.6]		40.2***	9.7	49.8***	7.6	17.3***	57.4***
Second	32.4 [25.2,40.6]		72.6 [65.9,78.4]		81.9 [74.0,87.8]		86.2 [79.6,90.9]		40.2***	9.3	49.5***	4.3	13.6**	53.8***
Middle	27.7 [22.2,34.0]		77.4 [70.9,82.8]		76.4 [68.8,82.6]		83.7 [77.3,88.7]		49.6***	-1.0	48.7***	7.3	6.4	56.0***
Fourth	26.3 [17.6,37.3]		76.8 [68.7,83.4]		77.2 [68.0,84.4]		88.3 [83.4,91.9]		50.6***	.4	50.9***	11.1*	11.5**	62.1***
Highest	29.6 [23.9,36.1]		69.5 [61.5,76.5]		75.6 [67.9,81.9]		73.6 [65.6,80.3]		39.9***	6.1	46.0***	-2.0	4.1	44.0***
Place of Residence		*						***						
Urban	22.0 [16.2,29.2]		71.4 [64.6,77.3]		76.3 [69.6,81.9]		73.0 [64.7,80.0]		49.3***	4.9	54.3***	-3.3	1.6	51.0***
Rural	31.4 [26.8,36.3]		73.5 [69.4,77.3]		78.3 [74.1,82.0]		86.7 [83.2,89.5]		42.2***	4.8	46.9***	8.4**	13.1***	55.3***
Region								**						
Kayes	32.3 [21.0,46.2]		67.9 [58.1,76.4]		79.1 [69.8,86.2]		88.3 [81.7,92.7]		35.6***	11.2	46.8***	9.1	20.4***	56.0***
Koulikoro	19.9 [14.2,27.1]		71.5 [62.6,79.0]		82.1 [74.0,88.0]		91.0 [83.9,95.1]		51.6***	10.6	62.2***	8.9	19.5***	71.1***
Sikasso	27.5 [20.3,36.1]		72.3 [63.8,79.4]		80.5 [70.3,87.9]		79.9 [73.0,85.5]		44.8***	8.3	53.0***	-.6	7.6	52.4***
Segou	31.0 [21.9,42.0]		82.4 [75.4,87.7]		71.4 [62.9,78.6]		87.7 [72.1,95.1]		51.3***	-11.0*	40.3***	16.3	5.3	56.6***
Mopti	40.2 [21.4,62.3]		75.2 [65.0,83.2]		80.7 [69.9,88.2]		92.2 [84.1,96.3]		35.0**	5.4	40.5***	11.5*	17.0**	52.0***
Bamako	22.9 [17.0,30.0]		63.6 [53.7,72.4]		73.2 [63.4,81.2]		70.2 [58.8,79.6]		40.7***	9.7	50.4***	-3.0	6.7	47.4***
Tombouctou	43.5 [32.7,55.1]						70.2 [60.3,78.6]							26.7***
Gao	15.6 [8.7,26.4]						77.2 [58.3,89.2]							61.6***
Kidal	3.8 [0.3,33.4]						13.0 [5.0,29.9]							9.2

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 13 ITN use by pregnant women in households owning at least 1 ITN, by background characteristics for four surveys

Variable	2006		2012-13		2015		2018		Difference² '2012-13'- '2006'	Difference² '2015'- '2012-13'	Difference² '2015'- '2006'	Difference² '2018'- '2015'	Difference² '2018'- '2012-13'	Difference² '2018'- '2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	55.6 [49.2,61.9]		83.8 [80.9,86.3]		81.6 [78.1,84.7]		91.0 [88.8,92.8]		28.1***	-2.1	26.0***	9.3***	7.2***	35.3***
Woman's Education														
None	56.2 [49.0,63.3]				81.1 [76.7,84.9]		91.0 [87.3,93.7]		24.9***				9.9***	34.8***
Primary	46.4 [35.8,57.3]				82.5 [68.0,91.3]		91.7 [81.1,96.6]		36.2***				9.1	45.3***
Secondary +	63.4 [49.0,75.7]				78.0 [63.2,88.0]		87.7 [77.6,93.7]		14.6				9.7	24.3**
Wealth Quintile								***						
Lowest	54.3 [46.8,61.6]		80.5 [74.2,85.6]		80.5 [71.6,87.0]		91.9 [86.4,95.4]		26.2***	-0.1	26.2***	11.5**	11.4**	37.6***
Second	60.7 [50.7,69.8]		81.9 [75.1,87.1]		82.9 [74.8,88.7]		94.9 [90.7,97.3]		21.2***	1.0	22.2***	12.1**	13.1***	34.3***
Middle	63.7 [54.6,71.8]		86.7 [80.8,91.0]		85.8 [77.4,91.4]		92.0 [87.0,95.2]		23.1***	-1.0	22.1***	6.2	5.3	28.3***
Fourth	49.4 [30.6,68.3]		87.7 [80.9,92.3]		81.4 [72.8,87.7]		94.6 [90.7,96.9]		38.3***	-6.3	32.0**	13.3***	7.0*	45.2***
Highest	50.5 [41.3,59.6]		81.2 [71.6,88.0]		77.9 [70.1,84.1]		80.4 [72.5,86.4]		30.7***	-3.2	27.5***	2.4	-0.8	29.9***
Place of Residence		**						***						
Urban	40.7 [28.8,53.9]		84.6 [78.9,88.9]		77.9 [70.9,83.6]		81.7 [74.1,87.4]		43.8***	-6.6	37.2***	3.7	-2.9	40.9***
Rural	61.2 [55.3,66.8]		83.6 [80.4,86.4]		82.7 [78.4,86.3]		93.4 [91.3,95.1]		22.4***	-0.9	21.5***	10.7***	9.8***	32.3***
Region								***						
Kayes	69.7 [56.0,80.6]		83.2 [75.3,88.9]		80.4 [70.7,87.4]		94.2 [88.9,97.1]		13.5*	-2.8	10.7	13.8**	11.0**	24.5***
Koulikoro	44.0 [34.0,54.5]		83.4 [76.6,88.5]		87.1 [78.1,92.8]		94.2 [87.3,97.5]		39.4***	3.7	43.1***	7.1	10.8*	50.2***
Sikasso	56.6 [46.3,66.3]		80.9 [73.1,86.8]		83.6 [73.2,90.5]		89.4 [83.8,93.2]		24.3***	2.7	27.0***	5.8	8.5*	32.8***
Segou	57.1 [45.4,68.1]		87.4 [81.3,91.7]		77.9 [70.0,84.1]		96.8 [92.2,98.7]		30.3***	-9.5*	20.8**	18.9***	9.4**	39.7***
Mopti	56.5 [30.0,79.8]		89.0 [81.9,93.5]		83.8 [69.8,92.1]		94.3 [86.8,97.6]		32.5**	-5.2	27.3*	10.5	5.3	37.8***
Bamako	45.5 [35.4,56.0]		76.1 [66.1,83.8]		75.4 [65.1,83.4]		78.0 [67.2,86.0]		30.6***	-0.7	29.9***	2.7	2.0	32.6***
Tombouctou	80.7 [62.8,91.2]						80.9 [72.3,87.2]							0.1
Gao	30.3 [14.4,53.0]						98.3 [91.9,99.7]							68.0***
Kidal	ND						ND							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference
ND = no data

Appendix Table 14 Percent of women with a live birth in the last 2 years reporting attending at least one antenatal care visit, by background characteristics

Variable	2006		2012-13		2015		2018		Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	71.3 [68.4,73.9]		75.0 [72.4,77.4]		78.9 [75.0,82.3]		80.7 [78.2,83.1]		3.7*	3.9	7.6**	1.8	5.7**	9.5***
Education		***		***		***		***						
None	67.7 [64.6,70.6]		71.4 [68.5,74.1]		75.4 [70.9,79.3]		75.9 [72.8,78.7]		3.7	4.0	7.7**	.5	4.5*	8.2***
Primary	87.6 [84.1,90.5]		87.3 [83.9,90.0]		86.7 [82.4,90.1]		88.5 [85.5,91.0]		-0.4	-0.6	-0.9	1.8	1.3	0.9
Secondary +	95.9 [93.6,97.5]		95.9 [93.5,97.5]		93.8 [91.5,95.5]		96.3 [94.9,97.4]		0.0	-2.2	-2.2	2.5*	0.4	0.4
Wealth Quintile		***		***		***		***						
Lowest	61.3 [56.9,65.5]		59.0 [54.4,63.4]		64.4 [53.0,74.3]		71.0 [65.9,75.7]		-2.3	5.4	3.1	6.7	12.0***	9.8**
Second	64.0 [60.0,67.7]		64.2 [59.9,68.2]		74.8 [69.6,79.4]		70.3 [65.4,74.8]		0.2	10.7**	10.9**	-4.5	6.1	6.3*
Middle	63.0 [58.2,67.6]		72.3 [68.5,75.8]		76.2 [71.6,80.2]		77.7 [73.7,81.3]		9.3**	3.9	13.2***	1.5	5.4*	14.7***
Fourth	76.0 [72.4,79.2]		85.6 [82.4,88.3]		85.8 [82.6,88.4]		88.9 [85.1,91.9]		9.6***	0.2	9.8***	3.1	3.3	12.9***
Highest	93.3 [91.1,95.0]		95.8 [94.0,97.1]		95.4 [93.4,96.8]		96.9 [95.6,97.9]		2.5	-0.4	2.1	1.5	1.1	3.6**
Place of Residence		***		***		***		***						
Urban	88.2 [84.9,90.9]		93.7 [91.1,95.6]		92.9 [89.3,95.3]		93.3 [89.4,95.9]		5.5**	-0.8	4.7*	0.4	-0.4	5.1*
Rural	64.5 [60.9,67.9]		70.1 [67.0,73.1]		75.4 [70.7,79.6]		77.2 [74.1,80.1]		5.7*	5.3	10.9***	1.8	7.1**	12.8***
Region		***		***		***		***						
Kayes	64.5 [55.2,72.8]		69.3 [61.3,76.3]		75.5 [65.2,83.4]		74.3 [66.8,80.6]		4.9	6.1	11.0	-1.2	5.0	9.8
Koulikoro	70.7 [60.4,79.2]		74.5 [67.4,80.6]		83.8 [77.4,88.7]		84.2 [77.3,89.3]		3.9	9.3*	13.1*	0.4	9.7*	13.5*
Sikasso	70.8 [64.4,76.5]		79.7 [75.2,83.6]		79.5 [72.4,85.2]		77.6 [70.7,83.2]		8.9*	-0.2	8.7	-2.0	-2.2	6.7
Segou	75.0 [67.7,81.1]		70.5 [64.2,76.1]		77.9 [71.3,83.4]		76.8 [69.2,83.0]		-4.5	7.4	2.9	-1.1	6.3	1.8
Mopti	68.9 [63.0,74.3]		61.9 [54.4,68.9]		62.6 [47.0,75.9]		84.2 [73.5,91.1]		-7.0	0.6	-6.3	21.6**	22.3***	15.3*
Bamako	95.0 [93.2,96.3]		95.2 [93.1,96.7]		95.0 [92.5,96.6]		96.0 [93.8,97.4]		0.2	-0.3	-0.1	1.0	0.7	1.0
Tombouctou	42.9 [32.1,54.4]						67.5 [59.1,74.8]							24.6***
Gao	60.4 [50.9,69.2]						61.1 [46.3,74.1]							0.7
Kidal	32.5 [11.6,63.9]						23.5 [12.2,40.5]							-9.0

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 15 Percent of women with a live birth in the last 2 years reporting attending at least four antenatal care visits, by background characteristics

Variable	2006 % [C.I.]	p-value[1]	2012-13 % [C.I.]	p-value[1]	2015 % [C.I.]	p-value[1]	2018 % [C.I.]	p-value[1]	Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
Total	35.4 [33.0,37.8]		41.2 [38.8,43.7]		37.2 [33.9,40.5]		43.3 [40.9,45.6]		5.9***	-4.1	1.8	6.1**	2.0	7.9***
Education		***		***		***		***						
None	31.2 [28.9,33.6]		36.5 [33.8,39.2]		32.6 [29.3,36.1]		36.3 [33.8,38.9]		5.2**	-3.8	1.4	3.7	-0.1	5.1**
Primary	51.3 [47.0,55.6]		55.7 [51.1,60.2]		47.5 [42.4,52.5]		50.8 [46.5,55.0]		4.4	-8.2*	-3.8	3.3	-4.9	-0.5
Secondary +	70.2 [64.6,75.1]		70.6 [66.3,74.5]		56.4 [50.9,61.7]		68.2 [64.4,71.8]		0.4	-14.2***	-13.8***	11.8***	-2.4	-2.0
Wealth Quintile		***		***		***		***						
Lowest	22.9 [19.6,26.6]		24.3 [21.0,28.0]		23.5 [17.2,31.3]		25.8 [22.1,29.8]		1.4	-0.8	0.6	2.3	1.5	2.9
Second	27.3 [24.1,30.7]		27.8 [24.2,31.8]		31.0 [26.0,36.5]		30.9 [27.2,34.8]		0.5	3.2	3.7	-0.1	3.1	3.6
Middle	28.4 [24.8,32.3]		35.2 [31.4,39.2]		32.1 [28.5,35.9]		37.2 [33.6,41.1]		6.8*	-3.1	3.7	5.2	2.1	8.8**
Fourth	36.0 [32.5,39.7]		50.5 [45.9,55.1]		41.8 [37.4,46.3]		51.6 [47.2,56.0]		14.4***	-8.7**	5.8*	9.8**	1.1	15.5***
Highest	63.8 [57.9,69.4]		71.1 [67.9,74.1]		60.3 [55.8,64.7]		72.7 [67.9,77.1]		7.3*	-10.8***	-3.5	12.4***	1.6	8.9*
Place of Residence		***		***		***		***						
Urban	54.8 [49.5,60.0]		66.6 [63.1,69.9]		55.6 [50.8,60.2]		66.7 [60.9,72.0]		11.8***	-11.0***	0.8	11.1**	0.1	11.9**
Rural	27.6 [24.9,30.5]		34.6 [31.7,37.7]		32.6 [29.0,36.5]		36.7 [34.0,39.5]		7.0***	-2.0	5.0*	4.1	2.1	9.1***
Region		***		***		***		***						
Kayes	33.3 [26.7,40.7]		41.1 [35.4,47.1]		37.8 [30.4,45.9]		42.6 [35.6,49.9]		7.8	-3.3	4.5	4.8	1.5	9.3
Koulikoro	36.6 [28.9,45.0]		44.5 [37.6,51.5]		44.6 [37.1,52.3]		48.8 [42.7,55.0]		7.8	0.1	8.0	4.3	4.4	12.2*
Sikasso	34.4 [29.6,39.5]		40.4 [35.3,45.6]		36.0 [31.4,40.9]		34.8 [29.6,40.3]		5.9	-4.4	1.6	-1.2	-5.6	0.4
Segou	33.8 [28.1,40.1]		35.4 [30.3,40.8]		31.9 [24.4,40.5]		36.0 [30.8,41.6]		1.6	-3.5	-1.9	4.2	0.6	2.2
Mopti	19.8 [14.8,25.9]		20.4 [15.6,26.2]		15.8 [10.7,22.8]		27.1 [21.0,34.3]		0.6	-4.5	-4.0	11.3*	6.8	7.4
Bamako	67.6 [62.5,72.2]		71.4 [67.3,75.2]		59.1 [54.7,63.4]		72.0 [64.6,78.4]		3.8	-12.3***	-8.4*	12.9**	0.6	4.4
Tombouctou	18.8 [12.0,28.2]						28.3 [20.1,38.3]							9.5
Gao	26.4 [17.2,38.3]						37.0 [25.6,50.2]							10.6
Kidal	22.9 [5.7,59.3]						9.4 [4.2,19.9]							-13.5

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 16 Percent of women with a live birth in the last two years reporting at least two doses of SP, by background characteristics

Variable	2006		2012-13		2015		2018		Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	11.2 [9.7,12.9]		30.0 [27.8,32.4]		44.4 [41.0,47.9]		55.4 [52.7,58.0]		18.8***	14.4***	33.2***	10.9***	25.3***	44.1***
Education		**		***		***		***						
None	10.6 [9.1,12.4]		28.5 [26.1,31.0]		41.2 [37.4,45.1]		51.2 [48.1,54.3]		17.9***	12.7***	30.5***	10.0***	22.7***	40.6***
Primary	13.4 [10.4,17.1]		34.5 [29.5,40.0]		50.4 [43.0,57.8]		58.3 [53.4,63.2]		21.1***	15.9***	37.0***	7.9	23.8***	44.9***
Secondary +	16.4 [12.4,21.3]		39.1 [33.3,45.3]		57.9 [50.7,64.9]		70.5 [66.9,74.0]		22.7***	18.8***	41.6***	12.6**	31.4***	54.2***
Wealth Quintile		***		***		***		***						
Lowest	11.2 [8.7,14.3]		20.9 [17.6,24.7]		36.2 [27.4,46.0]		47.6 [42.2,53.1]		9.7***	15.3**	25.0***	11.4*	26.7***	36.4***
Second	10.2 [8.0,12.9]		21.0 [17.8,24.7]		39.7 [34.1,45.6]		48.2 [43.5,53.0]		10.8***	18.7***	29.5***	8.5*	27.2***	38.0***
Middle	8.5 [6.3,11.5]		27.4 [23.3,31.9]		40.1 [35.3,45.1]		54.8 [50.3,59.3]		18.9***	12.7***	31.6***	14.7***	27.4***	46.3***
Fourth	10.1 [7.7,13.2]		36.2 [31.6,40.9]		48.8 [43.3,54.3]		62.2 [57.7,66.6]		26.0***	12.6***	38.7***	13.5***	26.1***	52.1***
Highest	16.9 [13.7,20.7]		46.0 [41.2,50.9]		59.8 [53.8,65.5]		66.0 [61.6,70.2]		29.1***	13.8***	42.8***	6.3	20.0***	49.1***
Place of Residence		**		***		***		***						
Urban	15.4 [12.1,19.4]		42.7 [38.4,47.2]		59.2 [54.0,64.3]		63.6 [59.6,67.4]		27.3***	16.5***	43.8***	4.4	20.8***	48.2***
Rural	9.7 [7.9,11.7]		26.8 [24.2,29.5]		40.9 [37.0,44.9]		53.2 [50.0,56.3]		17.2***	14.1***	31.2***	12.3***	26.4***	43.5***
Region		**		***		**		**						
Kayes	12.6 [7.5,20.3]		31.7 [27.2,36.5]		39.5 [31.8,47.8]		49.9 [43.3,56.6]		19.1***	7.9	26.9***	10.4*	18.3***	37.4***
Koulikoro	8.8 [6.0,12.7]		28.3 [22.6,34.9]		45.2 [38.7,52.0]		59.8 [52.3,67.0]		19.6***	16.9***	36.5***	14.6**	31.5***	51.1***
Sikasso	6.2 [4.5,8.4]		34.7 [29.4,40.5]		44.4 [38.2,50.9]		50.8 [44.3,57.2]		28.5***	9.7*	38.3***	6.3	16.1***	44.6***
Segou	13.2 [9.3,18.5]		25.9 [21.2,31.1]		47.2 [39.9,54.6]		59.4 [51.8,66.5]		12.6***	21.3***	34.0***	12.2*	33.5***	46.1***
Mopti	11.8 [7.4,18.4]		20.2 [16.1,25.0]		32.3 [21.0,46.0]		55.1 [47.8,62.2]		8.4*	12.1*	20.4**	22.9**	34.9***	43.3***
Bamako	20.5 [16.0,25.8]		39.6 [34.3,45.2]		59.5 [52.3,66.2]		63.6 [58.7,68.3]		19.1***	19.9***	39.0***	4.2	24.0***	43.1***
Tombouctou	8.8 [4.8,15.8]						42.3 [34.5,50.5]							33.5***
Gao	8.8 [5.7,13.5]						41.4 [24.4,60.8]							32.6***
Kidal							15.3 [8.5,26.1]							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 17 Percent of women with a live birth in the last two years reporting at least three doses of SP, by background characteristics

Variable	2006		2012-13		2015		2018		Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	5.9 [4.8,7.1]		11.8 [10.2,13.5]		21.0 [18.7,23.4]		28.3 [26.0,30.7]		5.9***	9.2***	15.1***	7.3***	16.5***	22.4***
Education		*		*		*		***						
None	5.5 [4.5,6.8]		10.9 [9.3,12.8]		19.8 [17.4,22.5]		25.9 [23.4,28.5]		5.4***	8.9***	14.3***	6.0**	14.9***	20.3***
Primary	6.9 [4.8,9.9]		15.2 [11.1,20.5]		23.2 [18.8,28.3]		29.5 [24.7,34.8]		8.3**	8.0*	16.3***	6.2	14.3***	22.6***
Secondary +	9.7 [6.6,14.1]		15.7 [12.0,20.3]		25.7 [21.4,30.5]		37.6 [33.4,42.0]		6.0*	9.9**	16.0***	11.9***	21.9***	27.9***
Wealth Quintile		**		***				**						
Lowest	5.8 [4.3,7.7]		5.4 [3.7,7.8]		18.4 [13.7,24.2]		23.0 [18.8,27.9]		-0.4	13.0***	12.6***	4.6	17.6***	17.2***
Second	5.1 [3.5,7.3]		7.7 [5.8,10.1]		22.2 [18.3,26.7]		24.6 [20.8,28.8]		2.6	14.5***	17.1***	2.4	16.9***	19.5***
Middle	4.3 [2.9,6.4]		10.1 [7.6,13.4]		18.7 [14.8,23.4]		29.0 [24.9,33.5]		5.8***	8.6***	14.4***	10.3**	18.9***	24.7***
Fourth	5.7 [4.0,8.1]		16.6 [13.1,20.7]		22.5 [18.6,26.9]		32.3 [28.5,36.4]		10.9***	5.9*	16.8***	9.8***	15.8***	26.6***
Highest	9.0 [6.8,11.9]		19.5 [15.7,24.0]		23.4 [18.4,29.3]		33.5 [29.2,38.1]		10.5***	3.9	14.4***	10.2**	14.0***	24.5***
Place of Residence		*		***		*		**						
Urban	8.0 [6.0,10.7]		17.6 [14.3,21.4]		25.0 [21.0,29.6]		33.7 [29.8,37.8]		9.6***	7.4**	17.0***	8.7**	16.1***	25.7***
Rural	5.1 [3.9,6.6]		10.3 [8.5,12.3]		20.0 [17.5,22.8]		26.8 [24.2,29.7]		5.2***	9.7***	14.9***	6.8***	16.6***	21.8***
Region		**		**		*		*						
Kayes	6.6 [3.4,12.3]		11.6 [8.4,15.6]		17.7 [13.1,23.4]		21.3 [15.4,28.5]		5.0	6.1*	11.1**	3.6	9.7**	14.7***
Koulikoro	5.3 [3.3,8.3]		10.1 [6.6,15.1]		20.9 [16.3,26.3]		33.6 [27.2,40.7]		4.8*	10.8**	15.6***	12.8**	23.6***	28.4***
Sikasso	3.5 [2.5,4.9]		14.7 [11.0,19.4]		22.2 [17.5,27.6]		26.8 [22.4,31.6]		11.2***	7.5*	18.7***	4.6	12.1***	23.3***
Segou	8.1 [5.0,12.8]		7.8 [5.0,12.1]		26.3 [21.3,32.0]		28.8 [23.5,34.8]		-0.3	18.5***	18.2***	2.5	21.0***	20.7***
Mopti	5.0 [2.8,8.8]		7.9 [5.1,12.0]		14.1 [8.7,22.0]		23.1 [16.8,31.0]		2.9	6.2	9.1**	9.0	15.2***	18.1***
Bamako	11.0 [7.8,15.3]		19.9 [15.7,24.7]		23.8 [18.4,30.2]		35.3 [30.8,40.1]		8.8**	4.0	12.8***	11.5**	15.5***	24.3***
Tombouctou	1.7 [0.6,5.0]						23.4 [19.2,28.2]							21.8***
Gao	1.1 [0.3,3.8]						32.4 [17.7,51.8]							31.3***
Kidal							13.7 [7.3,24.2]							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 18 Percent of women with a live birth in the last two years reporting 1 dose of SP, among those attending ANC at least once, by background characteristics

Variable	2006		2012-13		2015		2018		Difference² '2012-13'- '2006'	Difference² '2015'- '2012-13'	Difference² '2015'- '2006'	Difference² '2018'- '2015'	Difference² '2018'- '2012-13'	Difference² '2018'- '2006'
	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]	% [C.I.]	p-value[1]						
Total	21.7 [19.4,24.2]		72.1 [69.6,74.5]		82.0 [79.1,84.6]		88.9 [87.3,90.3]		50.4***	9.9***	60.3***	6.9***	16.8***	67.2***
Education								*						
None	21.2 [18.6,23.9]		71.6 [68.7,74.3]		81.6 [78.1,84.6]		87.8 [85.8,89.6]		50.4***	10.0***	60.4***	6.3***	16.2***	66.6***
Primary	22.8 [18.3,28.0]		72.3 [66.0,77.8]		82.4 [75.4,87.6]		90.4 [87.1,92.9]		49.5***	10.1*	59.6***	8.0**	18.1***	67.6***
Secondary +	26.5 [21.3,32.5]		75.3 [69.7,80.1]		84.1 [77.6,89.0]		91.4 [88.7,93.5]		48.7***	8.8*	57.6***	7.3**	16.2***	64.9***
Wealth Quintile		**		***										
Lowest	23.1 [19.0,27.9]		67.0 [61.6,72.0]		81.3 [73.7,87.2]		89.6 [85.4,92.7]		43.9***	14.3**	58.2***	8.3*	22.6***	66.5***
Second	19.7 [16.0,24.1]		65.7 [59.8,71.1]		80.1 [75.6,83.9]		87.3 [84.0,89.9]		46.0***	14.3***	60.3***	7.2**	21.5***	67.5***
Middle	17.0 [12.9,22.0]		68.1 [62.6,73.1]		83.3 [77.8,87.7]		88.6 [85.6,91.1]		51.1***	15.3***	66.4***	5.3	20.6***	71.7***
Fourth	20.1 [16.5,24.3]		76.4 [72.5,80.0]		79.5 [71.5,85.7]		89.7 [86.4,92.3]		56.3***	3.1	59.4***	10.2**	13.3***	69.6***
Highest	27.8 [23.5,32.6]		79.4 [75.9,82.5]		85.9 [81.4,89.4]		89.2 [85.7,92.0]		51.6***	6.5*	58.1***	3.3	9.8***	61.4***
Place of Residence		**		**		*								
Urban	27.1 [23.7,30.9]		77.9 [74.4,81.1]		86.3 [83.2,89.0]		88.4 [84.8,91.3]		50.8***	8.4***	59.2***	2.1	10.5***	61.3***
Rural	19.1 [16.2,22.4]		70.1 [66.9,73.2]		80.8 [77.1,84.0]		89.1 [87.2,90.7]		51.1***	10.6***	61.7***	8.3***	18.9***	70.0***
Region		***						*						
Kayes	20.8 [12.7,32.2]		75.5 [68.8,81.2]		80.1 [68.7,88.1]		91.9 [87.8,94.6]		54.7***	4.5	59.3***	11.8**	16.3***	71.0***
Koulikoro	15.5 [11.2,21.0]		72.4 [66.8,77.4]		75.4 [67.9,81.5]		88.0 [83.8,91.3]		56.9***	3.0	59.9***	12.7***	15.6***	72.5***
Sikasso	12.7 [9.6,16.5]		71.7 [65.8,76.9]		84.0 [78.8,88.1]		84.9 [79.6,89.0]		59.0***	12.3***	71.3***	.9	13.2***	72.2***
Segou	22.2 [16.0,30.0]		71.6 [64.4,77.9]		88.2 [83.7,91.6]		93.0 [89.6,95.4]		49.4***	16.6***	66.0***	4.8*	21.4***	70.8***
Mopti	32.8 [27.5,38.6]		64.7 [56.9,71.8]		82.0 [68.4,90.5]		91.4 [85.9,94.9]		31.9***	17.3*	49.1***	9.4	26.7***	58.6***
Bamako	29.7 [24.6,35.5]		75.9 [70.5,80.6]		84.9 [80.6,88.4]		87.8 [83.2,91.3]		46.1***	9.1**	55.2***	2.9	12.0***	58.1***
Tombouctou	26.7 [19.3,35.7]						84.6 [77.4,89.8]							57.9***
Gao	30.2 [24.5,36.5]						81.7 [65.1,91.5]							51.5***
Kidal							52.3 [35.7,68.4]							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 19 Percent of women with a live birth in the last two years reporting 2 doses of SP, among those attending ANC at least 2 times, by background characteristics

Variable	2006	p-value[1]	2012-13	p-value[1]	2015	p-value[1]	2018	p-value[1]	Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
Total	16.2 [14.0,18.6]		41.2 [38.5,43.9]		53.2 [48.9,57.4]		69.7 [67.3,72.1]		25.0***	12.0***	37.0***	16.6***	28.6***	53.6***
Education						*		*						
None	16.1 [13.7,18.9]		41.0 [38.0,44.1]		50.7 [46.1,55.3]		68.6 [65.4,71.6]		24.9***	9.7***	34.6***	17.9***	27.5***	52.5***
Primary	16.5 [12.8,21.1]		42.0 [36.0,48.3]		64.9 [54.7,73.9]		68.1 [63.1,72.8]		25.5***	22.9***	48.4***	3.2	26.1***	51.6***
Secondary +	16.3 [12.2,21.5]		41.1 [35.0,47.6]		58.9 [48.1,69.0]		74.5 [70.8,77.8]		24.8***	17.8**	42.6***	15.5**	33.3***	58.2***
Wealth Quintile				***										
Lowest	18.6 [14.9,23.0]		38.1 [32.1,44.5]		55.3 [45.4,64.8]		69.3 [62.6,75.3]		19.5***	17.2**	36.7***	14.1*	31.2***	50.8***
Second	15.5 [12.2,19.5]		33.6 [28.9,38.8]		50.7 [43.6,57.7]		69.4 [64.6,73.9]		18.1***	17.0***	35.1***	18.8***	35.8***	53.9***
Middle	13.4 [9.9,17.9]		37.9 [32.6,43.4]		49.1 [41.5,56.7]		69.7 [65.0,74.0]		24.5***	11.2*	35.7***	20.6***	31.8***	56.3***
Fourth	14.6 [11.1,19.1]		43.6 [38.8,48.5]		55.9 [43.7,67.4]		70.5 [66.1,74.5]		29.0***	12.2	41.2***	14.6*	26.9***	55.9***
Highest	18.5 [14.9,22.7]		48.6 [43.8,53.3]		56.0 [45.4,66.1]		69.6 [65.4,73.4]		30.1***	7.4	37.5***	13.6*	21.0***	51.1***
Place of Residence				*										
Urban	18.0 [14.0,22.8]		46.2 [41.8,50.7]		56.7 [47.4,65.5]		69.4 [65.8,72.7]		28.2***	10.5*	38.7***	12.7**	23.2***	51.4***
Rural	15.2 [12.6,18.3]		39.4 [36.1,42.7]		52.5 [47.7,57.3]		69.9 [66.8,72.8]		24.2***	13.1***	37.3***	17.3***	30.5***	54.6***
Region		*												
Kayes	21.4 [12.8,33.6]		44.6 [38.5,50.7]		40.6 [28.3,54.3]		71.8 [64.7,78.0]		23.1**	-3.9	19.2*	31.2***	27.3***	50.4***
Koulikoro	12.5 [8.7,17.7]		40.1 [33.4,47.2]		55.9 [47.0,64.4]		71.4 [64.9,77.1]		27.6***	15.8**	43.3***	15.5**	31.3***	58.9***
Sikasso	8.6 [6.2,11.7]		45.4 [39.3,51.6]		55.0 [46.3,63.4]		67.5 [61.4,73.1]		36.8***	9.7	46.5***	12.5*	22.2***	59.0***
Segou	18.8 [13.4,25.8]		37.2 [31.0,43.9]		58.3 [49.4,66.6]		75.5 [69.4,80.8]		18.4***	21.0***	39.4***	17.3***	38.3***	56.7***
Mopti	16.3 [9.0,27.7]		34.1 [27.3,41.7]		48.1 [36.5,59.9]		66.6 [57.7,74.4]		17.9**	14.0*	31.8***	18.5*	32.4***	50.3***
Bamako	22.3 [17.6,27.9]		42.1 [36.7,47.6]		60.9 [49.1,71.6]		67.4 [62.7,71.7]		19.8***	18.9**	38.6***	6.4	25.3***	45.1***
Tombouctou	20.8 [12.7,32.2]						64.0 [52.9,73.9]							43.2***
Gao	15.0 [9.7,22.6]						59.9 [36.7,79.4]							44.9***
Kidal							36.6 [25.3,49.6]							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.

Appendix Table 20 Percent of women with a live birth in the last two years reporting 3 doses of SP, among those attending ANC at least 4 times, by background characteristics

Variable	2006 % [C.I.]	p-value[1]	2012-13 % [C.I.]	p-value[1]	2015 % [C.I.]	p-value[1]	2018 % [C.I.]	p-value[1]	Difference[2] '2012-13'- '2006'	Difference[2] '2015'- '2012-13'	Difference[2] '2015'- '2006'	Difference[2] '2018'- '2015'	Difference[2] '2018'- '2012-13'	Difference[2] '2018'- '2006'
Total	8.6 [6.9,10.6]		19.3 [16.5,22.4]		33.8 [30.3,37.4]		41.8 [38.6,45.1]		10.7***	14.5***	25.2***	8.0**	22.5***	33.2***
Education						**								
None	8.6 [6.7,10.9]		18.7 [15.7,22.1]		37.7 [33.5,42.1]		42.0 [37.9,46.1]		10.1***	19.1***	29.1***	4.2	23.3***	33.4***
Primary	8.2 [5.2,12.6]		23.4 [17.1,31.0]		30.5 [23.3,38.7]		38.1 [31.1,45.6]		15.2***	7.1	22.3***	7.6	14.7**	29.9***
Secondary +	8.9 [5.3,14.5]		19.0 [14.1,25.1]		22.6 [16.1,30.8]		43.3 [38.3,48.5]		10.1**	3.7	13.7**	20.7***	24.3***	34.4***
Wealth Quintile														
Lowest	9.7 [6.8,13.8]		15.5 [10.4,22.5]		39.1 [30.7,48.2]		42.0 [33.6,51.0]		5.8	23.6***	29.4***	2.9	26.5***	32.3***
Second	8.2 [5.0,13.0]		14.4 [9.5,21.3]		40.2 [32.3,48.6]		42.4 [35.2,49.8]		6.3	25.8***	32.0***	2.2	27.9***	34.2***
Middle	6.9 [4.2,11.1]		16.3 [11.9,21.8]		33.9 [25.4,43.6]		42.2 [35.3,49.3]		9.4**	17.6***	26.9***	8.3	25.9***	35.2***
Fourth	8.5 [5.5,12.9]		22.3 [16.9,28.9]		32.7 [24.7,41.8]		44.2 [38.3,50.2]		13.8***	10.4*	24.2***	11.5*	21.9***	35.7***
Highest	9.2 [6.7,12.5]		21.7 [17.1,27.1]		28.2 [21.9,35.6]		39.4 [34.1,44.9]		12.5***	6.5	19.0***	11.2*	17.7***	30.2***
Place of Residence														
Urban	9.7 [7.2,12.9]		20.6 [16.3,25.7]		30.8 [25.4,36.8]		41.4 [36.6,46.4]		10.9***	10.2**	21.1***	10.6**	20.8***	31.7***
Rural	7.8 [5.7,10.5]		18.6 [15.1,22.7]		35.0 [30.6,39.6]		42.0 [37.8,46.3]		10.8***	16.4***	27.2***	7.0*	23.4***	34.2***
Region		*												
Kayes	11.4 [6.0,20.4]		20.2 [15.1,26.5]		32.4 [24.7,41.1]		34.4 [24.9,45.3]		8.9	12.1*	21.0***	2.0	14.1*	23.0***
Koulikoro	7.8 [4.5,13.1]		17.7 [11.3,26.6]		31.3 [23.3,40.5]		44.3 [36.7,52.1]		9.9*	13.6*	23.5***	13.0*	26.6***	36.5***
Sikasso	4.1 [2.4,6.8]		20.2 [14.2,27.8]		37.1 [29.6,45.2]		49.7 [42.1,57.4]		16.1***	16.9**	33.0***	12.6*	29.6***	45.7***
Segou	11.1 [7.0,17.3]		17.9 [10.7,28.4]		40.8 [30.5,52.0]		42.8 [33.4,52.7]		6.8	22.9**	29.7***	2.0	24.9***	31.7***
Mopti	4.1 [1.5,10.9]		12.6 [6.9,21.8]		34.5 [22.1,49.6]		31.4 [22.0,42.6]		8.5	22.0**	30.5***	-3.1	18.8**	27.3***
Bamako	12.2 [8.7,16.8]		22.6 [17.9,28.1]		29.3 [22.9,36.6]		42.0 [36.4,47.8]		10.5**	6.7	17.2***	12.6**	19.3***	29.8***
Tombouctou	6.8 [2.0,20.7]						36.4 [28.5,45.0]							29.6**
Gao	2.4 [0.3,16.9]						48.7 [26.5,71.5]							46.3**
Kidal							ND							

Notes: *p<0.05, **p<0.01, ***p<0.001
[1] p-value significance of the covariate in each survey
[2] Difference between the two surveys with the p-value of the difference.
ND = no data