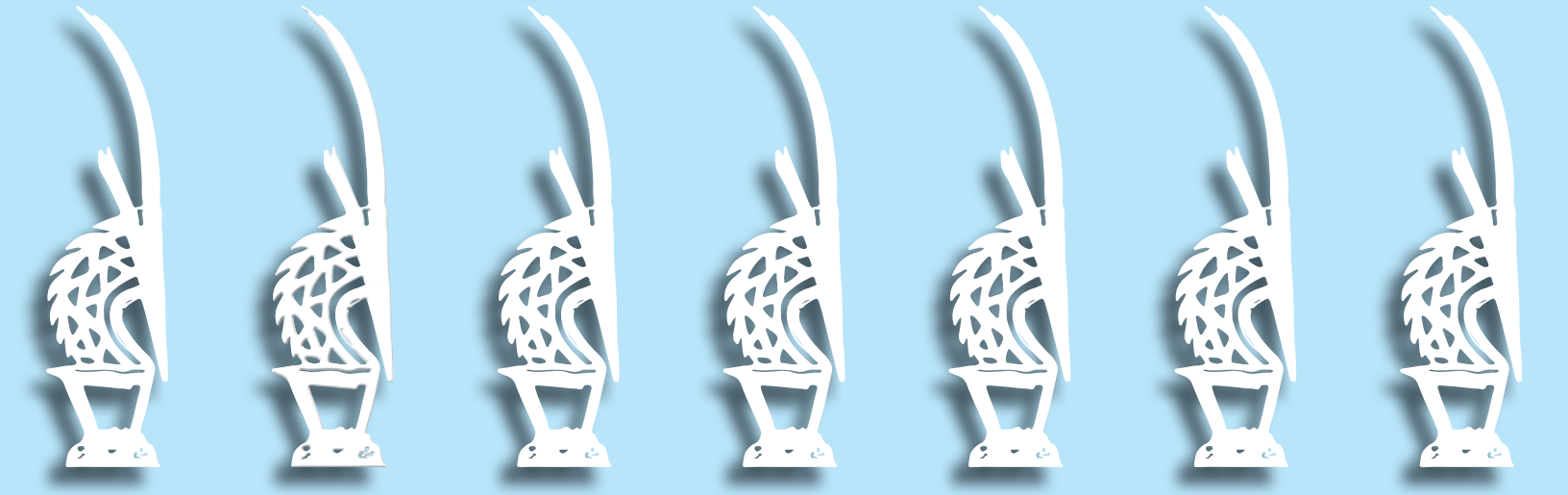
Inequalities in the Coverage of Reproductive, Maternal, Newborn, and Child Health Interventions in Mali

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



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

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ABSTRACT

This report examined the coverage of eight reproductive, maternal, newborn, and child health (RMNCH) indicators and analysed inequality stratified by wealth quintile for the Mali 2006, 2012-13, and 2017-18 Demographic Health Surveys. The coverage for these indicators are used by Countdown 2030 (www.countdown2030.org) to monitor progress on the RMNCH continuum of care, either separately for Countdown 2030 member countries or globally. Well-established absolute and relative measures of inequality are used to explore the progress in RMNCH coverage, which has been disaggregated by wealth quintiles.

Results from all measures of inequality revealed that greater inequalities between women in the top and bottom wealth quintiles were found for reproductive and maternal health care coverage, while the least inequality was observed for immunisation coverage outcomes.

Although long-term trends in the levels of coverage in the eight interventions have shown improvements from 2006 to 2017-18, the inequalities in health outcomes and intervention coverage are widening. Results from this analysis show that overall immunisation coverage in Mali continued to increase during the past decade, although the coverage for children of women in the poorest wealth quintile declined during that time.

The composite coverage score revealed that women in the wealthiest quintile were twice as likely as those in the poorest quintile to have coverage for the RMNCH interventions. In addition, the composite coverage scores underscore that gaps in reaching 100% universal coverage were substantial among all wealth status groups.

Key words: RMNCH, measures of inequality, countdown 2030, composite coverage index

ACRONYMS AND ABBREVIATIONS

ANC	antenatal care
ARI	acute respiratory infection
ARITRT	care seeking for treatment of ARI within 2 weeks
BCG	Bacillus Calmette-Guérin
CCI	composite coverage index
CIX	concentration index
DHS	Demographic Health Survey
DPT	diphtheria-pertussis-tetanus
FPSM	family planning satisfied with modern methods
GoM	Government of Mali
ITN	insecticide-treated nets
MCH	maternal and child health
mCPR	contraceptive prevalence rate for modern methods
MDG	Millennium Development Goal
MNCH	maternal, newborn, and child health
ORS	oral rehydration salts
PNC	postnatal care
RMNCH	reproductive, maternal, newborn, and child health
SBA	skilled birth attendant
SDG	Sustainable Development Goal
SII	slope index of inequality
UN	United Nations

1 INTRODUCTION

According to the United Nations (UN), Mali ranked 184 of 189 countries on the Human Development Index in 2019 (UNDP 2019). The conflict and insecurity that arose in Northern Mali in 2012 has continued to negatively affect the provision of health services to those in need and has created numerous challenges for population health (IPI 2019). Despite the unabated instability and conflict, the Government of Mali (GoM) and its technical and financial partners have undertaken a number of measures to improve children's health and nutritional status and to encourage positive health outcomes. In 2019, the GoM announced the provision of free health services to pregnant women, children younger than age 5, and the elderly. The country also plans to distribute free contraceptives and add thousands of health workers to its community healthcare system.

The health of mothers, newborn babies, and children involves sequential stages and transitions that build upon their natural interactions throughout the lifecycle. The continuum of care connects essential maternal, newborn, and child health (MNCH) integrated service delivery for mothers and children, beginning with pregnancy to childbirth, postnatal and newborn periods, and into childhood. The coverage of MNCH interventions is measured through time. The Demographic and Health Surveys (DHS) collect data that measure the coverage of MNCH interventions, such as the number of antenatal care (ANC) visits that measure care for pregnant women, and delivery by skilled birth attendants (SBA) that measures the provision of care during childbirth.

In the past decade, the *Countdown to 2015* initiative supported 75 "countdown countries" to achieve the Millennium Development Goals (MDGs) goals by 2015. This suggested that further gains were possible with intensified actions. Building on the successes of *Countdown to 2015*, *Countdown to 2030* began after the adoption of the Sustainable Development Goals (SDGs) by the UN. To achieve the SDGs by 2030, *Countdown to 2030* supports the monitoring and measurement of women's, children's, and adolescents' health in the 81 countries (including Mali) that account for 95% of maternal and 90% of all child deaths worldwide (UNICEF and WHO 2017). The SDGs' overarching principle of "no one left behind" focuses on health equity and reductions in inequality.

Research on health inequality in Mali is limited. A 2017 World Bank report indicated that significant inequalities remain in the coverage of seven service indicators (four or more antenatal care (ANC) visits, at least one tetanus vaccination during pregnancy, SBA, Bacillus Calmette–Guérin (BCG) vaccination, the third dose of a diphtheria-pertussis-tetanus (DPT) vaccine, measles vaccination, and access to improved drinking water in the household) in developing countries including Mali. The data, stratified by wealth quintiles, showed that only 17% of those from households in the poorest wealth quintile received at least six basic interventions versus 74% in the richest quintile.

The DHS data from 65 *Countdown to 2030* countries (which include Mali) revealed substantial wealth-related disparities in coverage (Countdown to 2030 Collaboration 2018). The data showed that half of the mother-child pairs in the poorest quintiles had coverage below 50%, compared with only 2% of those in the wealthiest quintiles. In 2016, Assaf and Pullum examined trends in 11 maternal and child health (MCH) indicators and found that Mali had significant health disparities across seven maternal and child health indicators (having four or more visits for ANC visits; the contraceptive prevalence rate for modern methods

(mCPR); delivery by a SBA; delivery in a health facility; completing three doses of DPT vaccine (DPT3); care seeking for symptoms of acute respiratory infection (ARI); and care seeking for diarrhoea. To ensure that Mali fulfils its commitment to the SDG's principle of "leaving no one left behind," timely monitoring of health inequality is important to improve the health status of those who are disadvantaged.

This report examines the coverage of eight reproductive MNCH interventions in Mali. These indicators include demand for family planning satisfied with modern methods (FPSM); for maternal health, four or more ANC visits among women who had a live birth in last 5 years (ANC4) and a birth assisted by a SBA; three indicators for child immunisation—BCG, three doses of DPT (DPT3) and measles; and management of child illness (treatment with oral rehydration salts (ORS) for the child's diarrhoea in the previous 2 weeks and care seeking for children under age 5 with symptoms of ARI in past 2 weeks (ARITRT)), disaggregated by wealth quintiles using data from the 2006, 2012-13 and 2017-18 Mali DHS. The objective is to provide information for policymakers and program administrators on the current health inequality in the coverage and design of future MCH programs.

2 DATA AND METHODS

2.1 Data

Data from Mali DHS surveys conducted in 2006, 2012-13 and 2017-18 were used for this further analysis. The DHS surveys (www.dhsprogram.com) are nationally representative, population-based household surveys that monitor demographic trends, use of family planning, ANC, delivery and PNC, children's health, and other health-related issues, as well as sociodemographic characteristics of women of reproductive age.

The 2012-13 DHS conducted in Mali coincided with a security crisis in the country that made the regions of Timbuktu (Tombouctou), Gao, Kidal, and part of Mopti inaccessible. The 2012-13 survey included the remaining five regions and the capital, Bamako, which are located in the south of the country. The excluded regions represent less than 10% of the total sample, and were included in the 2006 survey.

2.2 Methods

In 2000, the members of the UN committed to achieving eight MDGs by 2015. In 2015, 17 SDGs, which are to be achieved by 2030, were adopted at the UN Sustainable Development Summit. One of the SDGs, "Goal 3: Ensure healthy lives and promote well-being for all at all ages," focused on achieving RMNCH goals.

This study assessed levels of and changes in inequalities for eight *Countdown* indicators that measure the coverage of RMNCH interventions along four stages of the continuum of care: 1) reproductive care; 2) maternal care; 3) childhood immunisation; 4) and management of childhood illness. **Table 1** defines the eight indicators examined in this study, the base population for each, and the sample used to calculate each indicator.

Table 1 Reproductive, maternal, newborn, and child health (RMNCH) indicators used in the analysis, 2006 to 2017-18 Mali DHS

	Indicator	Definition	Base population	Sample		
				2006	2012-13	2017-18
Reproductive and maternal care	Demand for family planning satisfied by modern methods (FPSM)	Percentage of currently married women age 15-49 who have a met need for family planning	Currently married women age 15-49 who are using any modern contraceptive method	4,431	3,206	3,521
	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	9,087	6,773	6,623
	Births assisted by a skilled birth attendant (SBA)	Percentage of births that were assisted by an SBA	Children born in the 5 years before the survey	14,420	10,402	10,304
Child immunisation	Measles immunisation	Percentage of children age 12-23 months who received one dose of measles immunisation	Children born 12-23 months before the survey	2,626	1,846	2,048
	Three doses of diphtheria-pertussis-tetanus [DPT3]	Percentage of children age 12-23 months who have received the third dose of the DPT vaccine	Children born 12-23 months before the survey	2,626	1,846	2,048
	Bacillus Calmette-Guérin (BCG)	Percentage of children age 12-23 months who have received the BCG vaccine	Children born 12-23 months before the survey	2,626	1,846	2,048
Management of childhood illness	Treatment with ORS for children's diarrhoea (ORS)	Among children under age 5 with recent diarrhoea, the percentage treated with ORS	Children under age 5 with diarrhoea in the 2 weeks before the survey	1,660	832	1,631
	Care seeking for children's symptoms of ARI (ARITRT)	Among children under age 5 with recent symptoms of ARI, the percentage for whom care was sought from a health facility or provider	Children under age 5 with symptoms of ARI in the 2 weeks before the survey	706	158	191

The *Countdown to 2030* initiative (www.countdown2030.org) uses the composite coverage index (CCI) to monitor progress on the SDGs (Barros and Victora 2013). The CCI tends to be stable and serves as a proxy for universal health coverage in RMNCH (Countdown to 2030 Collaboration 2018). The CCI, a weighted average of the eight indicators along four stages of the continuum of care (reproductive health, maternal health, child immunisation, and management of child illness), is calculated with the following formula:

$$\text{CCI} = \frac{1}{4}\left(\boldsymbol{Fpsm} + \frac{\boldsymbol{ANC4+SBA}}{2} + \frac{\boldsymbol{BCG+2DPT+MSL}}{4} + \frac{\boldsymbol{ORS+CPNM}}{2}\right).$$

2.3 Measures of Inequality

Using the DHS wealth index, the sample was classified into quintiles from the first quintile (Q1)—the poorest 20% of the household population—to the fifth quintile (Q5)—the wealthiest 20%. We calculated four indices of inequality to measure health inequalities and assess the changes over time.

1. The absolute difference between Q5 and Q1 (Q5 minus Q1)

This indicator measures the gap in intervention coverage between the wealthiest and the poorest quintiles. This is a simple, straightforward measure of the disparities between the wealthiest and the poorest. Greater absolute values indicate greater disparities between the two groups. This indicator is limited because it is based only on the information of the two extreme groups and ignores the middle three wealth quintiles.

2. Slope index of inequality (SII)

The slope index of inequality (SII) measures the absolute difference between the wealthiest and the poorest groups, and considers the proportional distribution of the population within each wealth group. The SII denotes the percentage point difference in coverage between the poorest and the richest quintiles, and assumes a linear relationship in the ranking. The SII is zero if there is no inequality; greater absolute values represent higher levels of inequality.

3. Concentration index (CI)

Since the concentration index (CI) quantifies the degree of wealth-related inequality by using information from all five wealth quintiles, the index is a composite summary of inequality across the entire population with a range from -1 to +1. The index is zero when there is no inequality. Positive values indicate that the outcome is concentrated among the rich, while negative values indicate that the outcome is concentrated among the poor. The index magnitude reflects the degree of the inequality. We performed statistical tests to assess if the concentration indices are significantly different from zero and if the changes between any two surveys are statistically significant.

4. Regression coefficient of Q5 using Q1 as the reference after controlling for covariates

Multivariable regressions were used to quantify the disparities between the wealthiest and the poorest, after controlling for covariates that potentially affect the intervention coverage. Compared to other measures of inequality that do not account for other factors that may affect the difference between the wealthy and the poor, this measure is an adjusted indicator of inequality after controlling for other factors. The magnitude of the odds ratios of the top quintile (Q5) represents the degree of the inequality. Various covariates were controlled in the regressions such as women’s education, work participation, media exposure, religion, number of children (or parity), urban/rural residence, and region. For SBA, the number of ANC visits was also added to the regression. For child immunisation and care seeking indicators, the child’s age and sex were also added to the regressions.

3 RESULTS

3.1 Sample Description

Table 2 shows the distribution of MCH indicators by wealth quintiles. The three immunisation indicators—BCG, DPT, and measles—have the same denominator, which is children age 12-23 months. Overall, the sample size for each indicator is sufficient to generate reliable estimates by wealth quintile for most coverage indicators. However, since the sample sizes for the treatment of ARI symptoms, especially for the 2012-13 DHS and the 2018 DHS are small (see highlights), results for these two surveys should be interpreted with caution.

Table 2 Reproductive, maternal, newborn, and child health (RMNCH) indicators included in the analysis by wealth quintile, 2006 to 2017-18 Mali DHS

		Wealth quintile						
Indicators	Survey	Lowest	Second	Middle	Fourth	Highest	Total	Number
Demand for family planning satisfied by modern methods, currently married women age 15-49 (FPSM)	2006	17.2	17.9	17.3	18.8	28.7	100	4,431
	2012-13	15.8	17.2	19.1	22.9	25.1	100	3,206
	2017-17	18.7	18.0	20.9	21.7	20.8	100	3,521
Four or more ANC visits among women with a live birth in past 5 years (ANC4)	2006	19.9	20.1	20.6	20.4	19.0	100	9,087
	2012-13	20.3	20.5	20.1	20.7	18.4	100	6,773
	2017-18	19.4	20.7	21.0	20.0	18.8	100	6,623
Births assisted by a skilled birth attendant (SBA)	2006	20.5	20.7	21.0	20.4	17.4	100	14,420
	2012-13	20.9	20.9	20.8	20.7	16.7	100	10,402
	2017-18	21.2	21.3	21.7	18.9	16.9	100	10,304
Immunisation of children age 12-23 months (BCG, DPT, measles)	2006	18.5	20.3	22.1	21.0	18.0	100	2,626
	2012-13	19.4	20.9	19.5	22.3	17.9	100	1,846
	2017-18	19.4	23.0	21.0	19.3	17.3	100	2,048
Treatment with ORS for children's diarrhoea in the past 2 weeks (ORS)	2006	20.3	23.8	23.4	21.5	11.0	100	1,660
	2012-13	17.3	17.4	23.5	21.8	20.0	100	832
	2017-18	23.4	25.0	20.0	16.9	14.6	100	1,631
Care seeking for children under age 5 with symptoms of ARI in past 2 weeks (ARITRT)	2006	19.7	23.7	19.2	18.7	18.7	100	706
	2012-13	32.3	18.5	17.6	18.6	13.0	100	158
	2017-18	30.3	23.0	14.1	18.5	14.2	100	191

Table 3 shows the distribution of selected household, individual, and members characteristics by wealth quintiles. Indicators of use of improved drinking water, improved sanitation, and possession of insecticide-treated nets (ITN) were calculated from household level data, women's work participation, and women who reported serious problems in accessing health care. These indicators were derived from individual women, and the total who completed secondary school completion was calculated from individual data.

Inequalities in improved drinking water, improved sanitation, and problems accessing health care appear substantial between the poor (low 40%) and the richest (top 40%). Change in the use of improved drinking water among the poor (low 40%) was not substantial between 2006 and 2017-18. However, a nearly 30% increase was observed for households in the middle and the fourth quintile index during the same period. The results in **Table 3** show a substantial gap in access to improved water sources between the richest and the other wealth status groups in Mali. There was a steady progress in the proportion of households with access to improved sanitation facilities over the years. Improvements were observed across the years, although disparities in access to improved sanitation facilities among the wealth quintile groups is evident.

Over the decade—2006 to 2017-18—possession of ITNs increased by about 40% across all wealth status groups and, disparities among the wealth quintiles were less evident. **Table 3** also shows that, in Mali, attainment of completed secondary school is universally low, regardless of wealth status.

Women's work participation over the decade in Mali—the percentage of women age 15-49 currently working for cash only, cash and in-kind, or in-kind only—declined across all wealth quintiles over the three time periods and was especially notable among the poor (a decline of nearly 20%).

The percentage of women who reported serious problems in accessing health care for themselves was higher for those from poorer households than for those women from wealthier households. In 2006, nearly 71% of the poorest women reported serious problems in accessing health care, compared to 42% of the richest women. By 2017-18, problems accessing health care decreased by about 10 percentage points for the poorest and richest women. Overall, the gap in accessing health care between the poor and the rich women has not narrowed over the years.

Table 3 Percent distribution of households or household members, according to selected background characteristics by household wealth status, 2006 to 2017-18 Mali DHS

		Wealth quintile						
Characteristics	**Survey**	**Lowest**	**Second**	**Middle**	**Fourth**	**Highest**	**Total**	**N**
Use of improved drinking water sources	2006	36.8	44.9	46.0	58.3	92.8	56.0	12,988
	2012-13	35.5	54.2	66.3	80.1	96.2	66.0	10,105
	2017-18	33.0	53.2	72.2	87.1	96.6	68.7	9,510
Use of improved sanitation facilities	2006	1.6	4.1	6.0	12.6	27.5	10.5	12,988
	2012-13	4.0	9.5	18.9	31.5	48.0	22.0	10,105
	2017-18	10.7	17.7	31.5	42.5	49.4	30.5	9,510
Possession of insecticide-treated net (ITN)	2006	51.6	48.9	43.6	49.5	57.2	50.0	12,988
	2012-13	79.8	85.6	86.7	86.3	83.6	84.4	10,105
	2017-18	91.9	91.3	90.4	89.1	86.1	89.8	9,510
Secondary school completion	2006	0.0	0.0	0.0	0.2	3.8	0.8	54,730
	2012-13	0.0	0.1	0.2	0.5	6.2	1.4	42,601
	2017-18	0.0	0.0	0.2	1.5	8.4	2.1	41,695
Women's work participation	2006	54.1	54.9	53.5	49.6	48.6	51.9	14,583
	2012-13	24.2	25.3	29.7	37.6	36.8	31.1	10,424
	2017-18	30.7	34.3	40.1	44.7	46.3	39.8	10,519
Problems in accessing health care	2006	71.6	71.9	71.6	60.6	41.7	62.4	14,583
	2012-13	70.1	69.2	62.4	54.6	41.3	58.6	10,424
	2017-18	62.2	59.3	48.6	40.5	31.6	47.3	10,519

3.2 Levels and Trends in Reproductive, Maternal, Newborn, and Child Health (RMNCH) Intervention Coverage, by Wealth Status

This section reports levels and trends of the eight RMNCH interventions along four stages of the continuum of care—reproductive health, maternal health, child immunisation, and management of child illness—by wealth quintiles. In the equiplot graphs, the aligned dots represent the coverage of a given intervention for each wealth quintile (the first quintile includes the poorest 20% of the sample, and so on). The wealth quintiles are labelled q1 to q5. The distance between the dots measures the difference in coverage between the wealth quintile groups. The larger the difference, the bigger the absolute inequality. Improvement in inequality can also be assessed by checking if the dots that represent each quintile group are closer (or overlap) to each other and have moved closer to 100% over the years.

Figure 1a shows FPSM among married women in Mali for the three DHS surveys. Demand satisfied increased over time for all wealth quintile groups. For example, FPSM increased from 9% in 2006 to nearly 27% in 2017-18 among women in the poorest quintile. Similarly, demand satisfied increased among women in the richest quintile during the same period (from 34% in 2006 to 54% in 2017-18). However, disparities between the poor and the rich did not narrow over time, with poor married women having a lower percentage of demand satisfied than all other wealth groups.

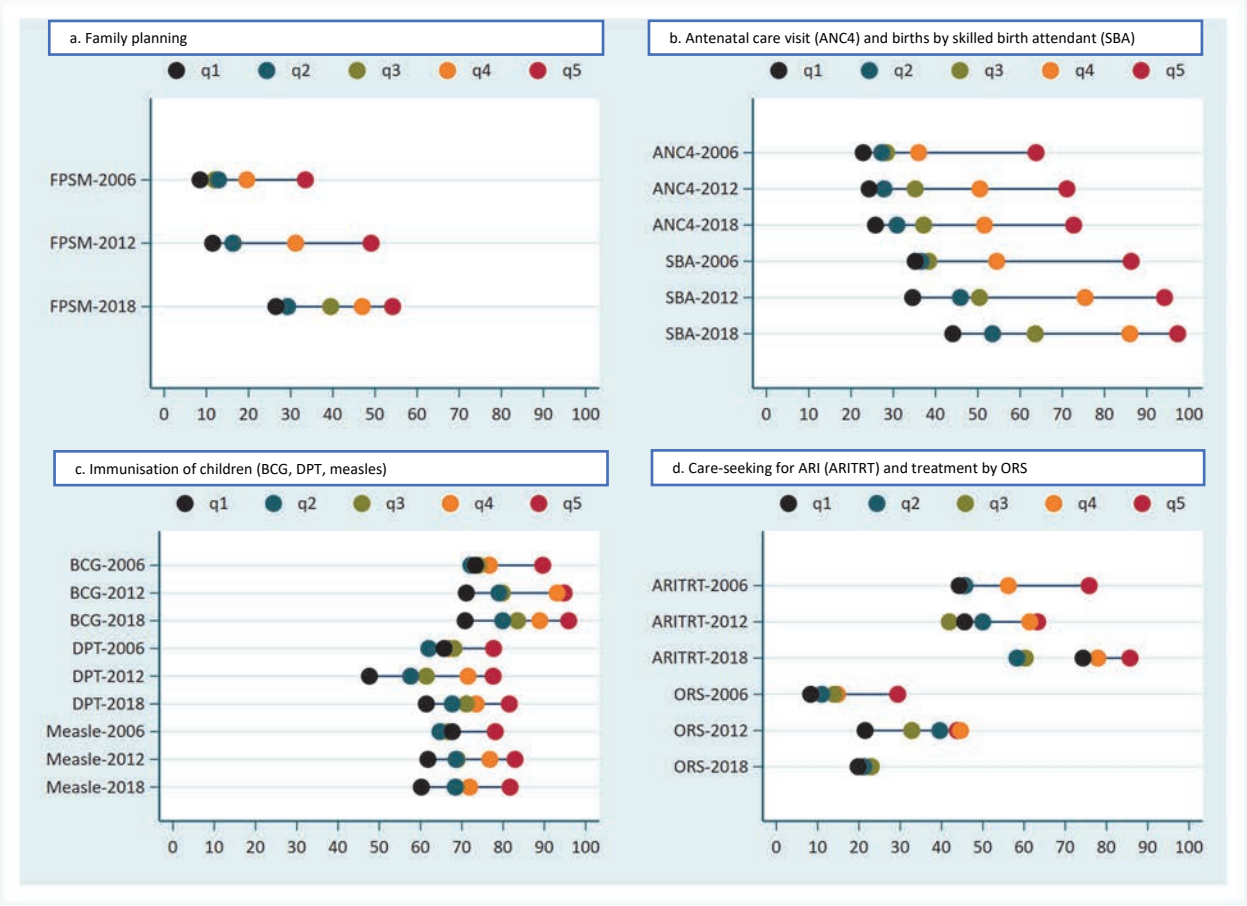
Figure 1b shows that access to maternal health care services is improving, although poor women have less access. The percentage with four or more ANC visits among poor women did not show substantive change over time, whereas for rich women, the percent with four or more ANC visits increased by more than 10% between 2006 and 2017-18. Similarly, a strong positive relationship is evident between household wealth status and use of a SBA during delivery. The use of the SBA is highest among the wealthiest group in all years. In addition, the disparity between rich and poor is substantial, with the 2017-18 coverage nearly universal (97%) for women in the richest quintile, and coverage of only 44% among the poor women.

Figure 1c shows a decline in childhood immunisation among children age 12 to 23 months in the poorest quintiles. Immunisation for measles declined from nearly 68% in 2006 to 60% in 2017-18. Nonetheless, the gap in immunisation coverage (BCG, DPT, and measles coverage) between the poor and the rich wealth quintiles is relatively small. As shown, overall immunisation coverage in Mali continued to increase over the past decade, although the coverage for children of women in the poorest wealth quintile declined from 2006 to 2017-18.

Figure 1d shows patterns in care seeking for symptoms of ARI and the treatment of child diarrhoea with ORS across levels of household wealth status. While improvements in the treatment of children's diarrhoea in the past 2 weeks with ORS among children in the poorest households have been observed (an increase from 8% in 2006 to 20% in 2017-18), large inequalities remain. Results of treatment of ARI symptoms in 2017-18 should be interpreted with caution due to small sample sizes for all wealth groups.

Overall, disparities appear to be largest for maternal health care services (ANC4 and SBA) and smallest for child immunisation indicators (BCG, DPT, and measles coverage).

Figure 1 Reproductive, maternal, newborn, and child health (RMNCH) intervention coverage by wealth quintiles, 2006 to 2017-18 Mali DHS



3.3 Changes in Inequalities

3.3.1 Absolute difference between the wealthiest and the poorest

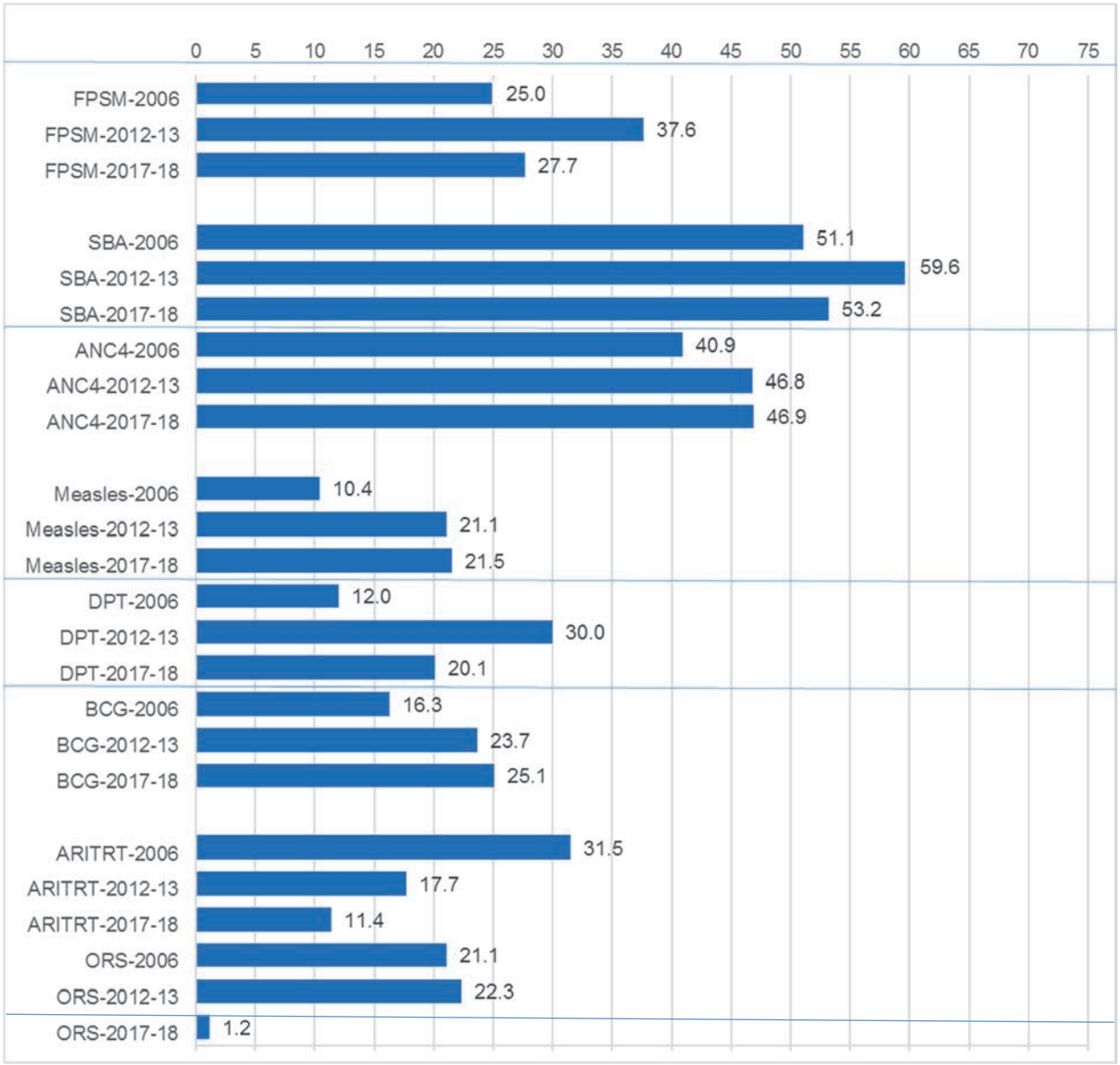
The absolute difference measures the percentage point difference between the poorest and the richest quintiles. A difference close to zero indicates coverage in RMNCH interventions is more equitable. **Figure 2** provides levels and trends of the eight RMNCH interventions that use an absolute measure of difference between the extreme wealth quintiles (Q5 and Q1). The magnitude of inequality is the largest for reproductive and maternal health care indicators. For example, the absolute difference for births assisted by a SBA was more than 50 percentage points higher for the richest women compared to the women in the poorest quintile in all surveys. Similarly, the coverage for four or more ANC visits among women with a live birth in past 5 years (ANC4) was 40 percentage points higher for the top wealth quintile than for the poorest quintile in 2006. However, the absolute difference increased to nearly 47 percentage points in 2012-13 and 2017-18.

Figure 2 also shows that coverage of child immunisation and management of childhood illness has low levels of inequality compared to the coverage of other indicators. For example, the absolute difference for the coverage of measles immunisation ranged from 10 percentage points in 2006 to 21 percentage points in 2017-18. The absolute difference between the wealthiest and the poorest women increased over time for

coverage of ANC (at least four visits), and immunisation coverage for BCG and measles, but decreased overtime for care seeking for children under age 5 with symptoms of ARI in past 2 weeks.

In sum, all interventions revealed huge inequalities between the richest and the poorest women and children, which were strongly driven by the low coverage among the poorest.

Figure 2 Trends in absolute differences between the wealthiest and the poorest in Mali, 2006 to 2017-18 Mali DHS

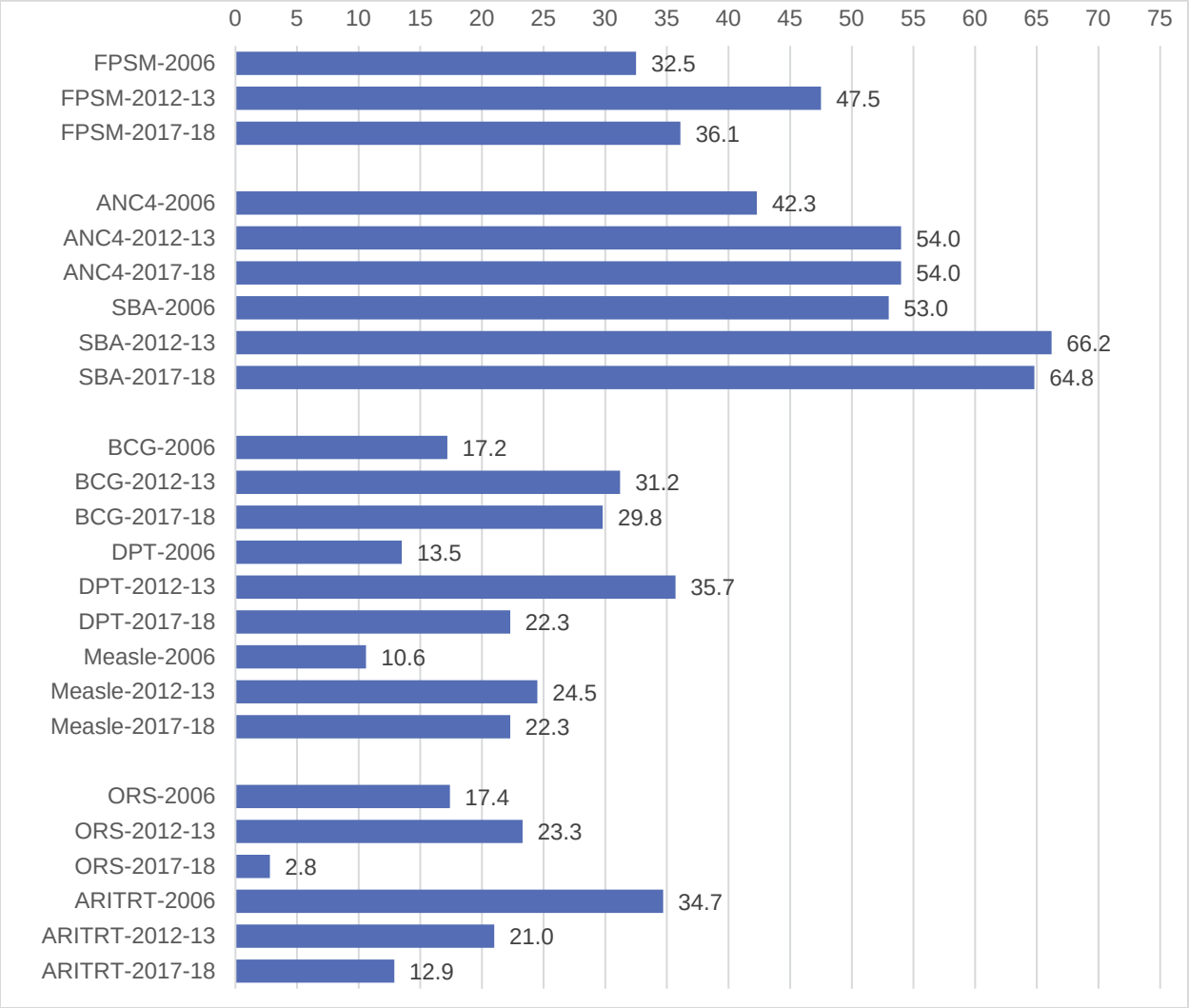


3.3.2 Absolute difference between the wealthiest and the poorest using the slope index of inequality (SII)

Figure 3 shows levels and trends of absolute differences for the eight RMNCH interventions calculated from the SII. The SII is less affected by sampling variability compared to the absolute difference between the poorest and the richest quintiles (Q5-Q1). After considering the distribution across all the wealth groups, the absolute differences between the two extreme wealth quintiles from SII are slightly larger in magnitude compared to the absolute differences shown in **Figure 2** (without adjusting for the size of the wealth groups). For example, for SBA, the absolute differences obtained from SII were 53, 66, and 65 percentage points in 2006, 2012-13, and 2017-18, respectively, to 51, 60, and 53 percentage points before the adjustment (see **Figure 2**). All results obtained from SII are similar to those obtained from the simple absolute difference in **Figure 2**. For example, the largest percentage point differences were for reproductive and maternal health care indicators (FPSM, ANC4, and SBA). The gap between the coverage levels for six of the eight indicators increased over time (except for treatment of child's diarrhoea with ORS and ARITRT). For example, SBA coverage at the top of the wealth quintile in 2017-18 was 65 percentage points higher than at the bottom, compared to 53 percentage points in 2006.

An improvement in the difference between coverage levels over time was observed for treatment of child's diarrhoea with ORS and ARITRT. In 2006, the difference between coverage levels for treatment with ORS for child's diarrhoea at the top of the wealth quintile was 17 percentage points higher than at the bottom. This decreased to 3 percentage points in 2017-18.

Figure 3 Trends in slope index of inequality (SII) in Mali, 2006 to 2017-18 Mali DHS



3.3.3 Concentration index

The concentration index (CIX) is a relative measure of inequality that shows the extent to which an intervention is concentrated among the wealthiest or the poorest. **Table 4** provides the CIX estimates and the tests of significance for the difference between two surveys for the eight indicators.

Table 4 shows that the CIX is significantly greater than zero for almost all coverage indicators in all surveys. This shows that the coverage of most interventions was concentrated among the wealthiest. Similar to the results obtained from the two absolute measures of inequality (SII and the difference between Q1 and Q5), greater inequalities (comparatively large and positive values of CIX) were found for demand for FPSM (CIX was 0.27, 0.28, and 0.14 in 2006, 2012-13, and 2017-18, respectively), four or more ANC visits among women with a live birth (CIX was 0.20, 0.22, and 0.21 for 2006, 2012-13, and 2017-18, respectively) and births assisted by a SBA (CIX was 0.18, 0.20, and 0.16 for 2006, 2012-13, and 2017-18, respectively). In addition, inequalities in coverage for these indicators did not significantly improve over time, except for

FPSM, in which inequalities significantly declined in 2018 compared to 2006 and 2012. The changes between 2006 and 2012 are not statistically significant.

Although the CIX coefficients were significantly different from zero, immunisation coverage outcomes have the smallest values, which show the least inequality in the coverage of these interventions.

Over all, long-term trends in the levels of coverage in the eight interventions have shown improvements during 2006 to 2017-18, although inequalities in coverage persist.

Table 4 Concentration index (CIX) estimates and tests of significance for difference between the surveys, 2006 to 2017-18 Mali DHS

	CIX estimates			Differences		
Surveys	**2006**	**2012-13**	**2017-18**	**2012-13 vs. 2006**	**2017-18 vs. 2012-13**	**2017-18 vs. 2006**
Demand for family planning satisfied by modern methods, currently married women age 15-49 (FPSM)	0.269***	0.284***	0.146***	0.015	-0.138***	-0.123***
Four or more ANC visits among women with a live birth in past 5 years (ANC4)	0.200***	0.220***	0.207***	0.021	-0.013	0.008
Births assisted by a skilled birth attendant (SBA)	0.184***	0.195***	0.160***	0.011	-0.035	-0.024
Immunisation of children age 12-23 months (BCG, DPT, measles) BCG	0.036***	0.058***	0.055***	0.022	-0.004	0.018
DPT	0.032***	0.092***	0.050***	0.059***	-0.042	0.017
Measles	0.025**	0.055***	0.050***	0.030	-0.004	0.025
Treatment with ORS for child's diarrhoea in the past 2 weeks (ORS)	0.199***	0.103***	0.020	-0.096	-0.083	-0.179
Care seeking for children under age with symptoms of ARI in past 2 weeks (ARITRT)	0.107***	0.066	0.027	-0.041	-0.039	-0.079

Significance level: *** p < 0.001; **p < 0.01; *p < 0.5

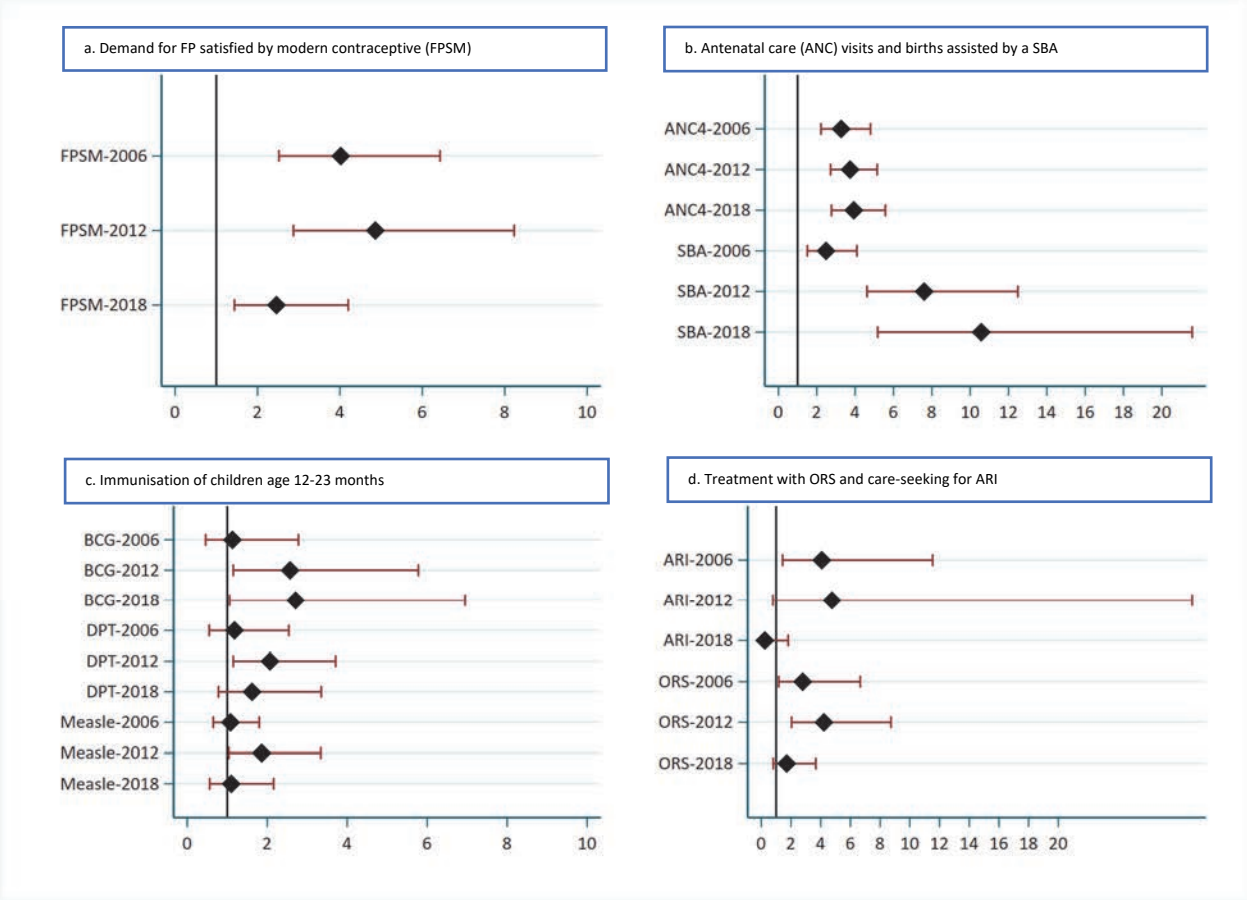
3.3.4 Odds ratios of the top quintile (Q5) from multivariable regression model using Q1 as the reference

Figure 4 presents odds ratios of the top quintile (Q5) obtained from multivariable logistic regression of the eight RMNCH indicators after controlling for wealth status, women's education, work participation, media exposure, religion, number of children (or parity), urban/rural residence, and region. The bottom quintile (Q1) was used as a reference for wealth status. Results from the separate regressions for each indicator revealed that the wealthiest are more able to obtain coverage than the poorest for RMNCH interventions (FPSM, ANC4, and SBA). The odds ratios for births assisted by a SBA, after adjusting for other factors in a multivariable logistic regression model, show that women in the top quintile were about 10 times more likely to have coverage than those in the poorest quintile in 2018-19. The results in **Figure 4b** revealed that the gap between the richest and poorest women in SBA coverage widens progressively from 2006 to 2017-18 (in 2006: AoR=4.3; 95% CI=(3.4, 5.3) and in 2017-18: AoR = 10.0; 95% CI =(7.1, 14.1)). The adjusted odds ratios for ANC4 coverage did not change between 2006 and 2017-18, which indicated that inequality did widen over time. For FPSM, **Figure 4a** shows that the gap in coverage between the top quintile and the

bottom decreased from 2006 to 2017-18 (in 2006: AoR=4.0; 95% CI=(2.5, 6.4) and in 2017-18: AoR = 2.5; 95% CI =(1.4, 4.2)).

Results in **Figure 4c** also show that after controlling for other covariates, the difference between the wealthiest and the poorest quintiles for immunisation coverage (BCG, DPT, and measles) was no longer significant, especially in 2006 and 2018.

Figure 4 Odds ratios of the highest quintile (Q5) compared to the lowest quintile (Q1) from multivariable regressions



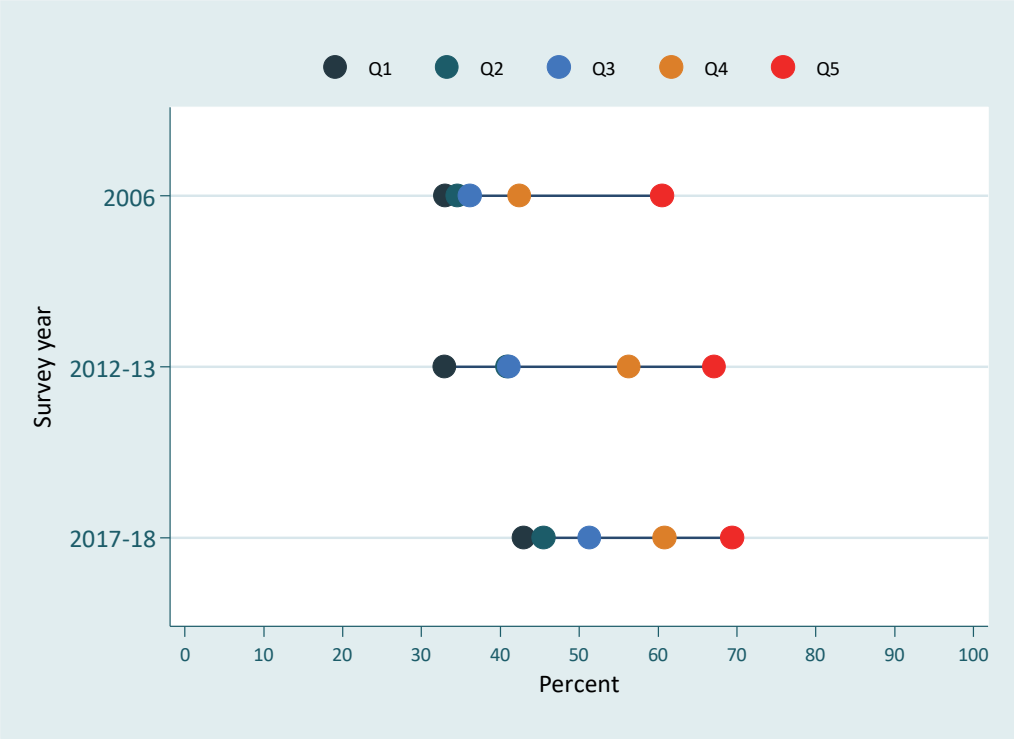
3.4 The Composite Coverage Index (CCI)

Figure 5 presents the composite coverage index (CCI) by wealth quintiles. Results in **Figure 5** reveal that the richest women generally have better coverage for the RMNCH interventions than the poorest women for all survey years. Despite improvement in coverage across all wealth quintiles, the inequality between the poor and the rich has persisted over time.

On average, the wealthiest quintiles were twice as likely as those in the poorest quintiles to have coverage for the RMNCH interventions. In 2006, the level of composite coverage for the poorest women was 33% compared to 61% for the richest women. This gap persisted in 2017-18, while the coverage for the poorest women increased by 10 percentage points from 2006 to 2017-18 (from 33% in 2006 to 43% in 2017-18). During the same period, coverage for the richest women increased by nearly 9 percentage points (from 61%

in 2006 to 69% in 2017-18). In general, the CCI scores show that gaps to reach 100% universal coverage were substantial among all wealth status groups.

Figure 5 Composite coverage index (CCI) for RMNCH interventions by wealth quintiles, 2006 to 2017-18 Mali DHS



4 DISCUSSION

This report examined the coverage of eight RMNCH indicators and analysed inequality stratified by wealth quintiles for Mali using the 2006, 2012-13, and 2017-18 DHS. The coverage for these indicators are used by the *Countdown 2030* initiative (www.countdown2030.org) to monitor progress on the RMNCH continuum of care, either separately for *Countdown 2030* member countries or globally. As Mali strives to ensure its commitment to the SDG's principle of leaving no one left behind, timely monitoring of health inequality is important to improve the health status of the disadvantaged.

In this report, we presented levels and trends of coverage and inequality among the eight interventions of RMNCH along four stages of the continuum of care—reproductive health, maternal health, child immunisation, and management of child illness—disaggregated by wealth quintiles. We used well-established absolute and relative measures of inequality to explore progress in RMNCH coverage disaggregated by wealth quintiles.

Mali has shown improvement in RMNCH interventions despite the challenges from the 2012 conflict that began in the northern part of the country. Access to improved water and sanitation, and possession of ITN have increased. However, the percentage of women age 15-49 currently working for cash only, cash and in-kind, or in-kind decreased from 2006 to 2017-18, which indicated a decline in women's work participation.

The findings from this analysis revealed that, in Mali, greater inequalities were found for FPSM, four or more ANC visits among women with a live birth (ANC4), and births assisted by a SBA. Conversely, child immunisation indicators (BCG, DPT, and measles) were the most equitable interventions. Other studies have reported similar findings for ANC4 and SBA coverage (Akseer et al. 2016, Keats et al. 2018, Sharma et al. 2017). A 2014 study by Castle et al., which used the 2006 and 2012-13 Mali DHS, reported significant inequalities across multiple measures of socioeconomic status in nearly all child health indicators and that such inequalities tend to persist over time. Similarly, Assaf and Pullum (2016) and the World Bank (2017) also reported that significant inequalities remain in the coverage of MCH care interventions, especially ANC4, SBA, and child immunisation coverage of BCG, DPT, and measles.

Our analysis of the CCI revealed that only about half of the population is benefitting from the eight essential RMNCH interventions, and that coverage is even lower among less wealthy households. The findings revealed that women in the wealthiest quintile group were twice as likely as those in the poorest quintile to have coverage for the RMNCH interventions. Although the coverage for the poorest women increased by 10 percentage points from 2006 to 2017-18 (from 33% in 2006 to 43% in 2017-18), the gap in coverage persisted between 2006 and 2017-18. In general, the CCI scores underscore that gaps to reach 100% universal coverage were substantial among all wealth status groups.

5 CONCLUSIONS

The 2012 conflict that arose in Northern Mali continued to worsen the provision of health services to those in need and has created numerous challenges for the health of the population (IPI 2019). Despite these challenges, the findings from this analysis showed that progress has been made in improving the coverage of the eight RMNCH indicators, access to improved water and sanitation, possession of ITNs, and reducing problems in accessing health care in Mali. In 2019, to scale-up and maintain these improvements, the GoM announced the provision of free health services to pregnant women, children younger than age 5, and the elderly. The country will also be distributing free contraceptives and adding thousands of health workers to its community healthcare system.

Our analysis revealed that the levels and long-term trends in coverage of the eight interventions have shown improvements during 2006 to 2017-18. However, we have concern that inequalities in health outcomes and intervention coverage are widening. For example, the odds ratios for births attended by a SBA, after adjusting for other factors in a multivariable logistic regression model, show that women in the top quintile were about 10 times more likely to have coverage than the poorest quintile. In addition, results from this analysis show that while overall immunisation coverage in Mali continued to increase over the past decade, the coverage for children of women in the poorest wealth quintile declined from 2006 to 2017-18.

In general, our analyses show that work is needed to achieve universal coverage of the RMNCH continuum of care interventions and for Mali to fulfil its commitment to achieve the SDG's principle of "leaving no one left behind." The GoM, with its partners, may need a national action plan with programmatic responses to overcome inequalities in the coverage of RMNCH interventions between the rich and the poor and the diminished coverage of some interventions among the poor.

REFERENCES

Akseer, N., Z. Bhatti, A. Rizvi, A. S. Salehi, T. Mashal, and Z. A. Bhutta. 2016. "Coverage and Inequalities in Maternal and Child Health Interventions in Afghanistan." *BMC Public Health* 16 (Suppl 2): 797. https://doi.org/10.1186/s12889-016-3406-1.

Assaf, S. and T. Pullum. 2016. *Levels and Trends in Maternal and Child Health Disparities by Wealth and Region in Eleven Countries with DHS Surveys*. DHS Comparative Reports No. 42. Rockville, MD, USA: ICF International. https://dhsprogram.com/pubs/pdf/CR42/CR42.pdf.

Barros, A. J. D., and C. G. Victora. 2013. "Measuring Coverage in MNCH: Determining and Interpreting in Equalities in Coverage of Maternal, Newborn, and Child Health Interventions." *PLoS Med* 10 (5): e1001390. https://doi.org/10.1371/journal.pmed.1001390.

Castle, S., R. Scott, and S. Mariko. 2014. *Child Health and Nutrition in Mali: Further Analysis of the 2012-13 Demographic and Health Survey*. DHS Further Analysis Reports No. 92. Rockville, MD, USA: ICF International. https://dhsprogram.com/pubs/pdf/FA92/FA92.pdf.

Countdown to 2030 Collaboration. 2018. "Countdown to 2030: Tracking Progress towards Universal Coverage for Reproductive, Maternal, Newborn, and Child Health." *The Lancet* 391 (10129): 1538–48. https://doi.org/10.1016/S0140-6736(18)30104-1.

International Peace Institute (IPI). 2019. *International Peace Providing Healthcare in Armed Conflict: The Case of Mali*. New York, NY, USA: International Peace Institute. https://www.ipinst.org/wp-content/uploads/2019/01/IPI-E-RPT-Providing-HealthcareMali.pdf.

Keats, E. C., N. Akseer, Z. Bhatti, W. Macharia, A. Ngugi, A. Rizvi, et al. 2018. "Assessment of Inequalities in Coverage of Essential Reproductive, Maternal, Newborn, Child, and Adolescent Health Interventions in Kenya." *JAMA Network Open* 1 (8): e185152. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2719572.

Sharma, J., H. H. Leslie, F. Kundu, and M. E. Kruk. 2017. "Poor Quality for Poor Women? Inequities in the Quality of Antenatal and Delivery Care in Kenya." *PLoS ONE* 12 (1): e0171236. https://doi.org/10.1371/journal.pone.0171236.

United Nations Children's Fund (UNICEF) and the World Health Organization (WHO). 2017. *Tracking Progress towards Universal Coverage for Reproductive, Newborn, and Child Health: The 2017 Report*. Washington, DC, USA: UNICEF and WHO. https://countdown2030.org/pdf/Countdown-2030-complete-with-profiles.pdf.

United Nations Development Programme (UNDP). 2019. Human Development Report 2019: Inequalities in Human Development in the 21st Century. New York, NY, USA: UNDP. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/MLI.pdf.

World Bank. 2017. *Tracking Universal Health Coverage: 2017 Global Monitoring Report.* Washington, DC, USA: The World Bank Group.
http://documents.worldbank.org/curated/en/640121513095868125/Tracking-universal-health-coverage-2017-global-monitoring-report.

APPENDIX

Table A1 **Percentage distribution of RMNCH interventions by wealth quintiles, the difference between Q5 and Q1, and the Slope Index of Inequality, 2006 to 2017-18 MALI DHS**

Indicator	Survey year	Q1	Q2	Q3	Q4	Q5	Total	Q5-Q1	SII
Demand for family planning satisfied by modern methods, currently married women AGE 15-49 (FPSM)	FPSM-2006	8.5	12.9	12.0	19.6	33.5	19.2	25.0	32.5
	FPSM-2012-13	11.5	16.3	16.4	31.2	49.1	27.2	37.6	47.5
	FPSM-2017-18	26.5	29.3	39.5	47.0	54.2	39.9	27.7	36.1
Four or more antenatal care visits among women with a live birth in past 5 years (ANC4)	ANC4-2006	22.9	27.3	28.4	36.0	63.8	35.4	40.9	42.3
	ANC4-2012-13	24.3	27.8	35.2	50.5	71.1	41.2	46.8	54.0
	ANC4-2017-18	25.8	30.9	37.2	51.6	72.7	43.3	46.9	54.0
Births assisted by a skilled birth attendant (SBA)	SBA-2006	35.2	36.6	38.4	54.5	86.3	49.0	51.1	53.0
	SBA-2012-13	34.6	45.9	50.4	75.4	94.2	58.6	59.6	66.2
	SBA-2017-18	44.1	53.5	63.6	86.0	97.3	67.3	53.2	64.8
Immunisation of children age 12-23 months (BCG, DPT, measles)	BCG-2006	73.3	72.2	74.0	76.7	89.6	76.9	16.3	17.2
	BCG-2012-13	71.1	79.0	79.8	93.1	94.8	83.6	23.7	31.2
	BCG-2017-18	70.8	79.9	83.5	88.9	95.9	83.4	25.1	29.8
	DPT-2006	65.7	62.0	68.1	66.9	77.7	67.9	12.0	13.5
	DPT-2012-13	47.6	57.6	61.4	71.5	77.6	63.1	30.0	35.7
	DPT-2017-18	61.4	67.7	71.1	73.5	81.5	70.7	20.1	22.3
	Measle-2006	67.7	64.7	66.8	66.9	78.1	68.6	10.4	10.6
	Measle-2012-13	61.8	68.6	68.9	76.8	82.9	71.7	21.1	24.5
	Measle-2017-18	60.2	68.4	68.6	71.9	81.7	69.8	21.5	22.3
Treatment with ORS for child's diarrhoea in the past 2 weeks (ORS)	ORS-2006	8.3	11.0	14.0	14.8	29.4	14.0	21.1	17.4
	ORS-2012-13	21.5	39.6	32.8	44.6	43.8	36.8	22.3	23.3
	ORS-2017-18	19.8	21.2	23.0	22.7	21.0	21.4	1.2	2.8
Care seeking for children under age 5 with symptoms of ARI in past 2 weeks (ARITRT)	ARITRT-2006	44.3	45.7	45.5	56.2	75.8	53.0	31.5	34.7
	ARITRT-2012-13	45.6	50.0	41.9	61.4	63.3	51.0	17.7	21.0
	ARITRT-2017-18	74.3	58.3	60.3	77.9	85.7	70.9	11.4	12.9

Table A2 Odds ratios from multivariable logistic regression

Indicators		Survey year	Odds ratios	95% Confidence Interval
Demand for family planning satisfied by modern methods, currently married women age 15-49 (FPSM)	FPSM	2006	4.02	(2.52, 6.43)
		2012-13	4.86	(2.87, 8.23)
		2017-18	2.46	(1.44, 4.20)
Four or more antenatal care visits among women with a live birth in past 5 years (ANC4)	ANC4	2006	3.27	(2.22, 4.8)
		2012-13	3.74	(2.72, 5.15)
		2017-18	3.93	(2.77, 5.58)
Births assisted by a skilled birth attendant (SBA)	SBA	2006	4.25	(3.44, 5.26)
		2012-13	7.02	(5.63, 8.76)
		2017-18	9.99	(7.07, 14.12)
Immunisation of children age 12-23 months (BCG, DPT, measles)	BCG	2006	1.66	(0.98, 2.81)
		2012-13	1.91	(0.94, 3.91)
		2017-18	2.16	(1.01, 4.62)
	DPT	2006	1.29	(0.84, 1.99)
		2012-13	1.71	(1.06, 2.78)
		2017-18	1.35	(0.76, 2.40)
	Measles	2006	1.41	(0.91, 2.18)
		2012-13	1.39	(0.82, 2.34)
		2017-18	1.10	(0.63, 1.92)
Treatment with ORS for child's diarrhoea in the past 2 weeks (ORS)	ORS	2006	4.40	(2.12, 9.12)
		2012-13	3.46	(1.71, 7.00)
		2017-18	2.40	(1.26, 4.56)
Care seeking for children under age 5 with symptoms of ARI in last 2 weeks (ARITRT)	ARITRT	2006	4.06	(1.56, 10.57)
		2012-13	4.20	(0.77, 22.94)
		2017-18	0.29	(0.03, 2.54)