Nigeria Health, Population, and Nutrition Multi-Activity Evaluation Baseline
DHIS2 Service Utilization Results Brief

Data for Impact (D4I) is conducting a prospective mixed-methods portfolio evaluation of four USAID/Nigeria Health, Population, and Nutrition (HPN) activities, with a focus on comparing an integrated health programming approach with a disease-focused approach (malaria). Evaluation results will inform adaptive program implementation and support USAID/Nigeria's investment strategy prioritization to improve health outcomes. The evaluation is being implemented in three case study states (Table 1).

The purpose of this brief is to summarize initial findings from descriptive analysis of select malaria, antenatal care (ANC), and family planning (FP) service provision outcomes in the district health information system (DHIS2). Current results differ from preliminary analyses presented in June 2022 due to refinement in the handling of missing values, particularly for the percentage of facilities reporting for each service in the analysis; substantive divergence from previous results is where applicable.

Intervention Models

- **Integrated approach**: The Integrated Health Project (IHP) implements a fully integrated set of reproductive, maternal, newborn, and child health plus nutrition and malaria (RMNCH+NM) and health system strengthening interventions;

- **Disease-focused approach**: The President's Malaria Initiative for States (PMI-S) focuses on malaria health programming and health system strengthening; and

- Both models include **demand creation** (led by Breakthrough ACTION – Nigeria) and **commodity procurement and distribution** (led by Global Health Supply Chain Program – Procurement and Supply Management) interventions.

Table 1. Intervention components by evaluation case-study state

State	Intervention	Activity Start	Activity End
Ebonyi	Integrated + Disease-focused	IHP: April 2020	IHP: December 2024
		PMI-S: January 2020	PMI-S: January 2025
Kebbi	Integrated (IHP)	April 2019	March 2024
Zamfara	Disease-focused (PMI-S)	August 2020	June 2025

Notes: Activity implementation dates in all evaluation states for Breakthrough ACTION – Nigeria were July 2017 – September 2026, and for the Global Health Supply Chain Program – Procurement and Supply Management activity are July 2016 – November 2023.

Evaluation Question

The evaluation seeks to answer the following broad evaluation question related to health programming effectiveness: Did malaria and other health behavior and service delivery outcomes improve more from baseline to endline in Local Government Authorities (LGAs)/states where an integrated approach was implemented, a disease-focused approach was implemented, or a combination of the two?

Methods

The objective of the study is to examine differences in reporting completeness and health service use trends among states receiving an integrated health programming approach, a disease-focused (malaria) approach, or both. Results include an assessment of trends over time within each state as well as descriptive comparisons and trends among the three case study states.

Data Sources and Indicators

Time series data were obtained from the Nigeria DHIS2 at the facility-month level for the period January 2017 through March 2022 (63 months). Facilities were eligible for study inclusion if they were primary health care centers (PHCs)[1] in the three case study states. The six malaria, ANC, and FP data elements listed below were extracted and analyzed; facilities were only included in the study if they reported on at least one of the six service use variables for at least one month during the study period.

- Persons under-five presenting with fever and tested by RDT
- Persons under-five with confirmed uncomplicated malaria
- Persons under-five with confirmed uncomplicated malaria treated with ACT
- Pregnant women that attended ANC first visit (ANC1)
- Pregnant women who received malaria intermittent preventive treatment first dose (IPTp1)
- New female family planning acceptors

Analytical Approach

Two indicators are reported for each of the six health service use variables. First, the percentage of facilities reporting the service delivery variable by month is assessed to understand how facility-level reporting of health service delivery data has changed over time. The calculation for the percentage of facilities reporting during month m is the number of facilities reporting the service in month m divided by the total number of facilities in the study period.

Second, the state-level average number of cases or clients per facility by month is analyzed to understand how state-level service delivery volumes change over time. Although study data were obtained at the facility-month level, health service utilization is analyzed as mean cases per month per facility at the state level due to high rates of missing data at the facility-month level. The calculation for the average number of cases in month m is the total number of cases reported by facilities in the state during month m divided by the number of facilities in the state that report data on the service in month m.

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[1] Future DHIS2 analysis will restrict the study sample to public PHCs as coded in the DHIS2 database. Due to DHIS2 database access issues, current results are not restricted to public facilities, and non-primary health centers were manually excluded from analysis based on facility name (e.g., facilities with 'hospital' in the name were removed).

The analysis focuses on trends in monthly mean service volumes across states over time rather than absolute service levels within each state because absolute service levels are not directly comparable due to population and facility coverage variations across states and over time.

Baseline Findings

Records for 2,456 facilities in the three study states were extracted from the DHIS2. Ninety-three percent of the extracted facilities were eligible for study inclusion after excluding duplicate facility records and manually removing non-primary health centers based on facility name information. The 2,284 PHC facilities included in analysis [2] reported on at least one study variable during the study period: over 96 percent of facilities across the three states reported on under-five malaria services, two-thirds reported on ANC first visits and IPTp1, and 70 percent reported on new female family planning acceptors.

Figure 1 shows the percentage of PHC facilities reporting on each health service variable by state. While nearly all facilities in each state report on the under-five malaria variables, facilities in Ebonyi were most likely and facilities in Zamfara were least likely to report on first ANC visit, receipt of IPTp1, and new female family planning acceptors.

Figure 1. Percentage of facilities that ever report on health service study variables between January 2017 – March 2022, by state (2,284 facilities)
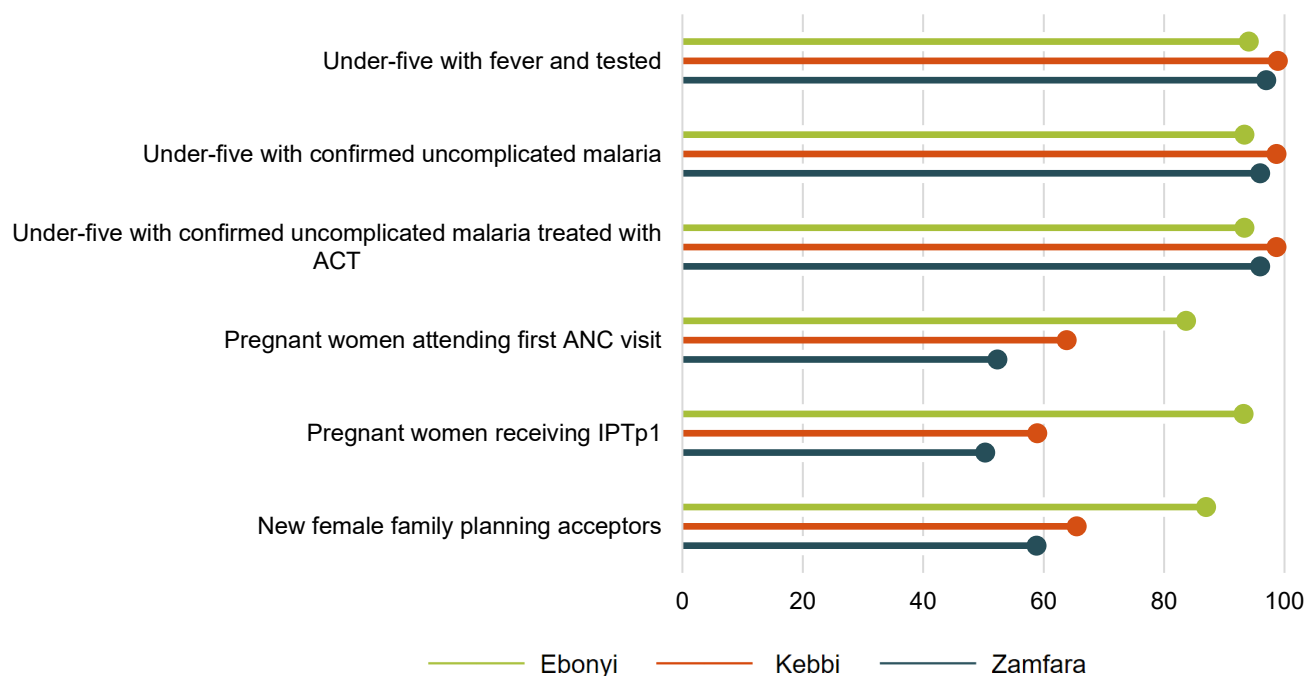
Malaria

Figures 2, 3, and 4 present time trends in facility reporting rates and state-level average case volumes per facility for RDT testing among children under-five presenting with fever, confirmed uncomplicated malaria among children under-five, and confirmed uncomplicated malaria cases treated with ACT among children under five.[3]

Reporting Rates

Reporting rates for the three malaria study variables increased throughout the study period in all three states. Trends in reporting rates were similar for malaria variables within each state but differed markedly among the states. Malaria variable reporting rates at the end of the study period were highest in Ebonyi at 90 percent, compared to slightly over 70 percent in Kebbi and Zamfara.

In Ebonyi, reporting rates for under-five malaria variables increased approximately 40 percentage points from January 2017 through March 2022, from just over 50 percent at the beginning of the study period to 90 percent at the end of the study period. Reporting rates improved to around 73 percent from January 2017 until January to April 2020, when PMI-S and IHP began working in Ebonyi and improved another 20 percentage points after the two activity start dates.

In Kebbi, under-five malaria variable reporting rates improved from 40 percent in January 2017 to 70 percent in March 2022, however most of the improvement occurred prior to the April 2019 start of IHP programming. After IHP began working in Kebbi reporting rates improved from around 68 percent to a high of 77 percent during the first quarter of 2021, but then declined to just over 70 percent by the end of the study period.

Lastly, malaria reporting rates in Zamfara improved from 55 percent at the start of the study to over 70 percent at the end of the study. Reporting rates peaked around 73 percent during the second quarter of 2018, and then decreased to 65 percent in August 2020 when PMI-S began working in Zamfara.

Case Volume

The average number of under-five patients with fever tested by RDT, confirmed to have uncomplicated malaria, and treated with ACT declined overall in Ebonyi, remained relatively stable in Kebbi, and increased in Zamfara during the study period. In all three states throughout the study period nearly all cases of confirmed uncomplicated malaria were reported to have been treated with ACT.

Prior to PMI-S and IHP activity start dates in Ebonyi, average caseloads for each malaria variable fluctuated with overall increases until the third quarter of 2019. Average caseloads per facility began to decline before PMI-S and IHP activities began and continued to decrease until the end of the study period.

Some seasonality in mean caseloads for each malaria variable is observed throughout the study period in Kebbi and Zamfara. Average caseloads per facility in Kebbi were slightly higher in March 2022 than those observed at the start of the study period in January, whereas in Zamfara average caseloads increased over thirty percent between January 2017 and March 2022. In Kebbi, the seasonal peaks in the malaria

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[3] Results presented in June 2022 showed relatively stable reporting rates and caseloads over time in general. After additional data processing, reporting rates for the malaria study variables increased throughout the study period in all states and average facility caseloads increased in Zamfara.

caseload variables were lower in 2020 and 2021 than 2017 to 2019. In Zamfara, the seasonal peaks were highest in 2019 and the malaria caseload variables increased in the first two quarters in 2022, contrary to the expected seasonal pattern.

Figure 2. Percentage of facilities reporting and average monthly cases: RDT testing among children under-five presenting with fever

Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.
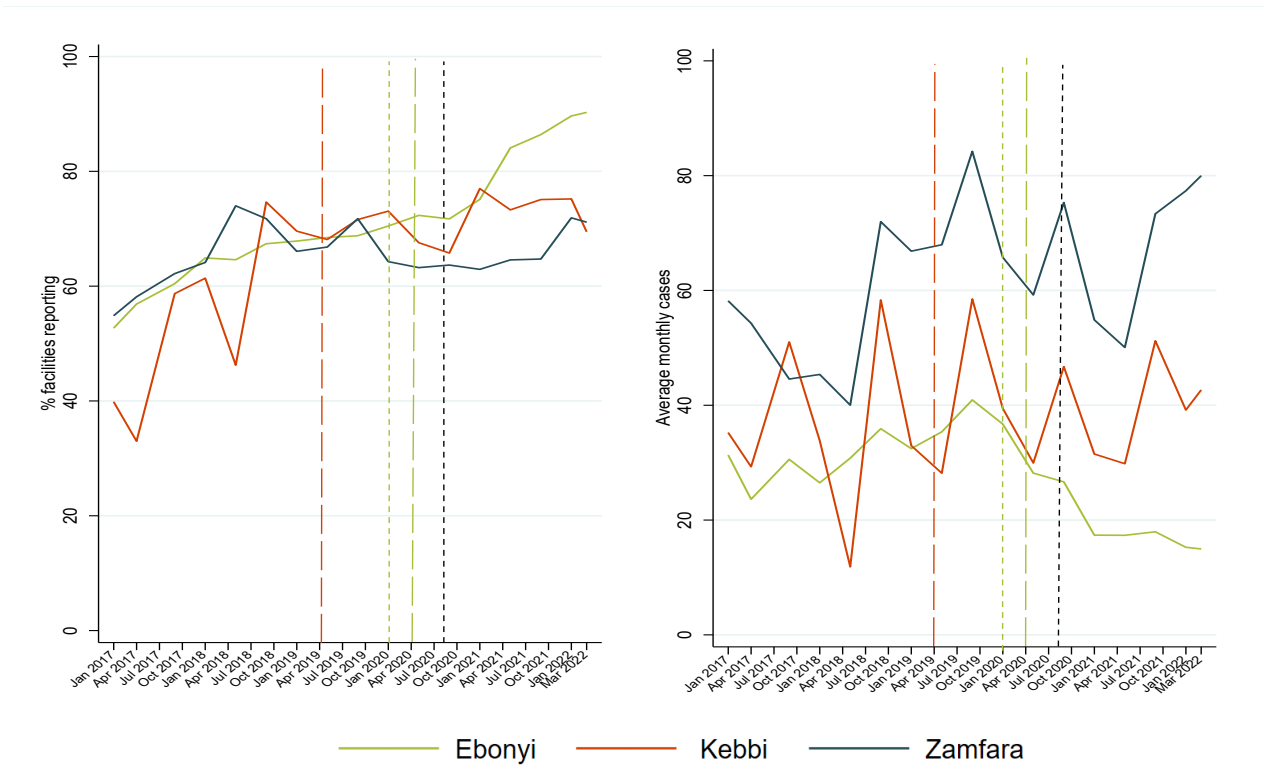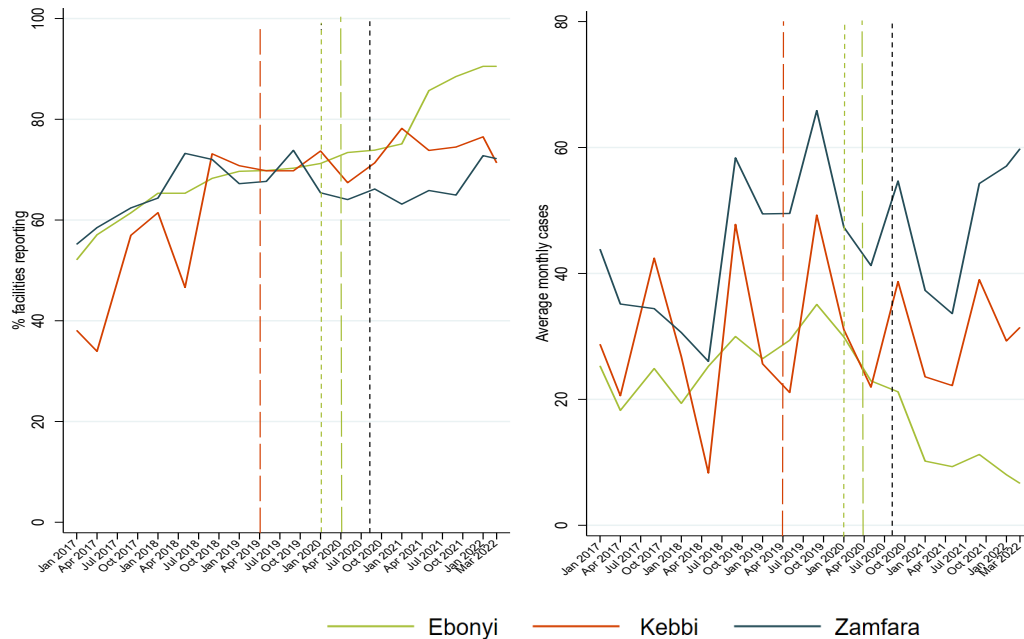
Figure 3. Percentage of facilities reporting and average monthly cases: confirmed uncomplicated malaria among Children under-five

Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.

Figure 4. Percentage of facilities reporting and average monthly cases: confirmed uncomplicated malaria cases treated with ACT among children under-five
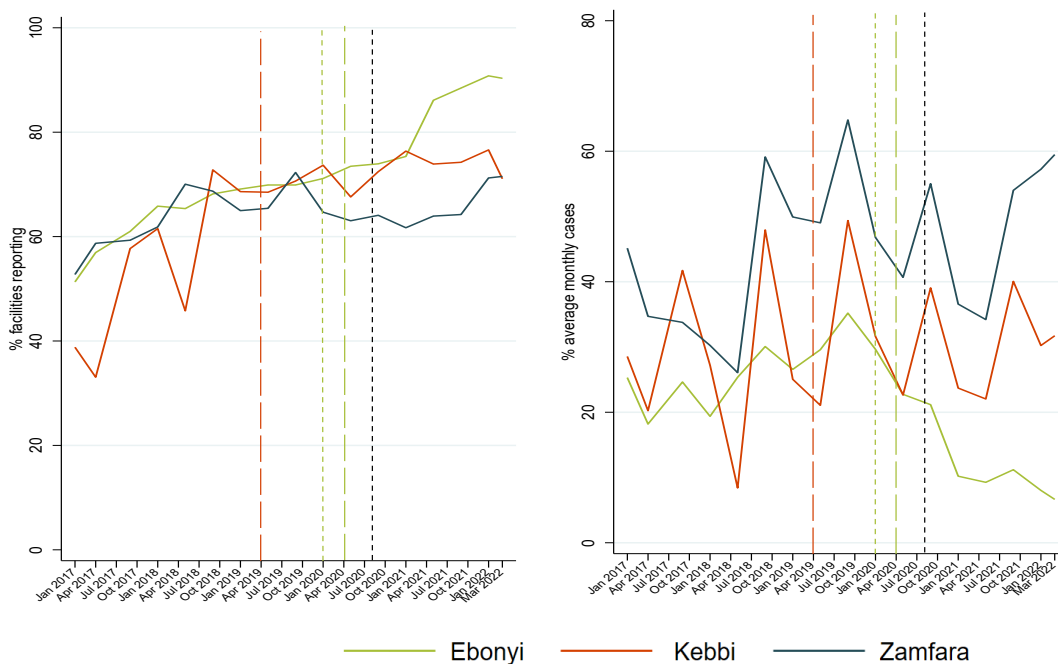
Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.

ANC and IPTp1

Figures 5 and 6 show the time trends in facility reporting rates and state-level average client volumes per facility for women attending their first ANC visits and for pregnant women receiving IPTp1.[4]

Reporting Rates

Reporting rates for first ANC visit and pregnant women receiving IPTp1 increased overall and after activity start dates in each state. At the end of the study period, reporting rates for both variables were nearly 95 percent in Ebonyi and over 80 percent in Kebbi and Zamfara.

ANC1 and IPTp1 reporting rates both steadily improved in Ebonyi prior to PMI-S or IHP activity initiation, from 57 percent to 80 percent for ANC1 reporting and from 45 to 73 percent for IPTp1 reporting. After April 2020, ANC1 reporting rates improved a further 15 percentage points and IPTp1 reporting rates improved a further 20 percentage points to nearly 95 percent in March 2022.

In Kebbi, ANC1 and IPTp1 reporting rates improved by approximately 50 percentage over the study period. Most reporting improvement occurred prior to IHP implementation in April 2019, with an approximately 40 percentage point increase in reporting both variables from roughly 30 percent in January 2017 to over 70 percent in April 2019, compared to a roughly 10 percentage point increase between April 2019 and March 2022.

In Zamfara, ANC1 and IPTp1 reporting rates improved from approximately 30 percentage points from January 2017 until the start of PMI-S programming in August 2020, from 50 percent to just under 80 percent. ANC1 reporting rates improved an additional seven percentage points to 84 percent in March 2022, and IPTp1 reporting rates had little overall additional change.

Client Volume

The mean number per facility of first ANC visits and pregnant women receiving IPTp1 decreased overall in all three states during the study period. Client loads for both variables fluctuated throughout the study period in Kebbi and Zamfara, with some suggestion of seasonality, whereas they were relatively stable in Ebonyi. Ebonyi facilities had the lowest average client volume for both ANC1 and IPTp1.

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[4] Results presented in June 2022 showed relatively stable reporting rates and mean number of clients per facility over time in general, compared to revised results which show increased reporting rates over time and an overall decline in facility ANC1 and IPTp1 client volumes during the study period.

Figure 5. Percentage of facilities reporting and average monthly clients: first ANC visit
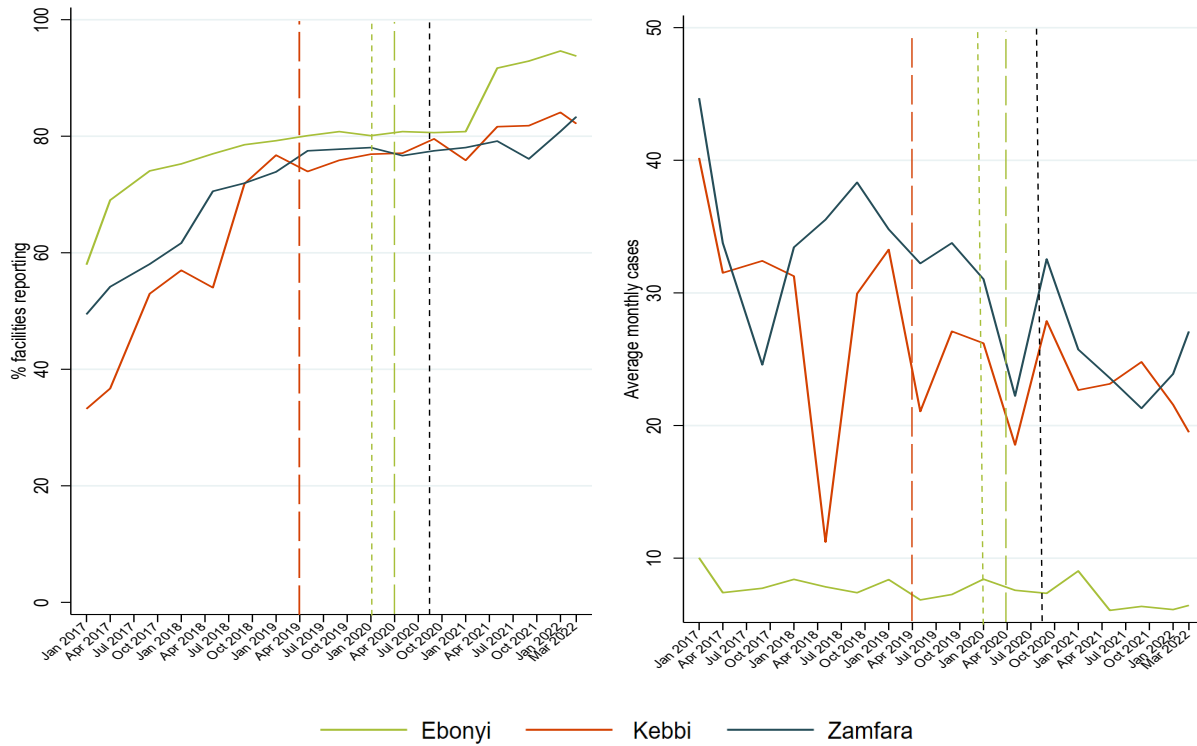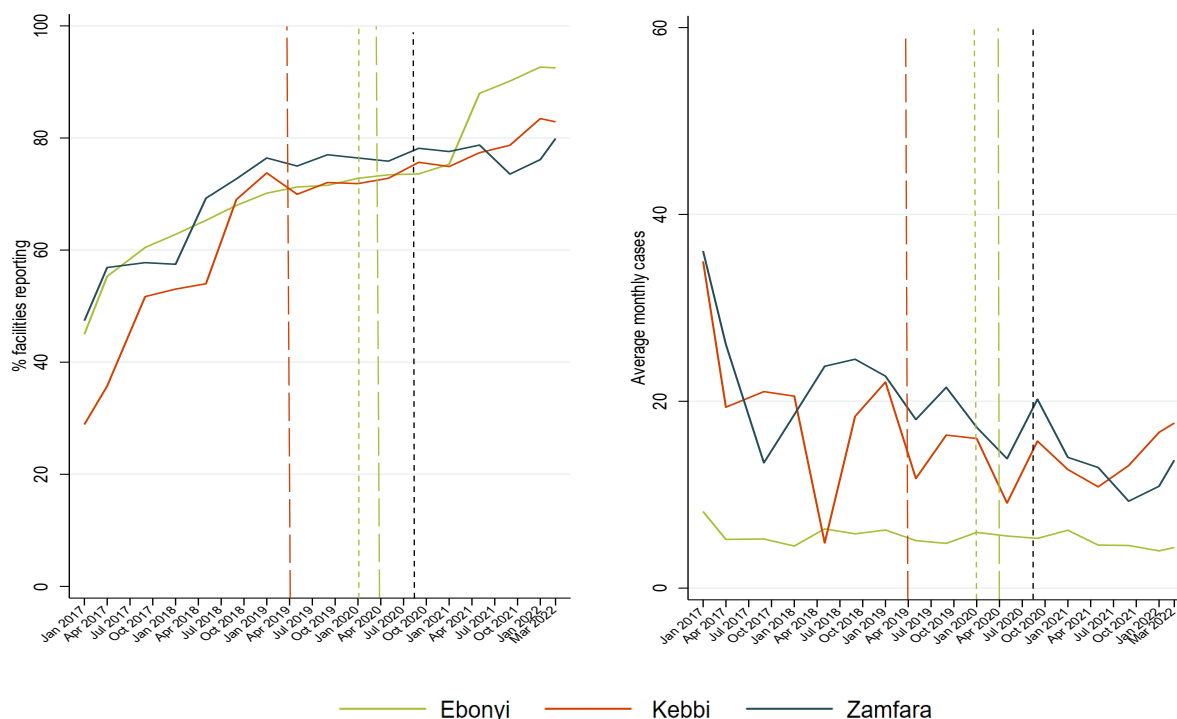

Ebonyi ——— Kebbi ——— Zamfara

Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.

Figure 6. Percentage of facilities reporting and average monthly clients: receipt of IPTp1 among pregnant women

Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.

Family Planning

Figure 7 shows the time trends in facility reporting rates and state-level average client volumes per facility for new female family planning acceptors. [5]

Reporting Rates

Reporting rates for new female family planning acceptors increased by 50 percentage points or more in each study state between January 2017 and March 2022.

Most reporting improvements occurred prior to activity start dates. Family planning reporting rates increased from 40 percent to 75 percent at the time IHP and PMI-S began working in Ebonyi, from 25 percent to 65 percent at the time IHP began working in Kebbi, and from 30 percent to 75 percent when PMI-S began work in Zamfara in August 2020.

New female family planning acceptor reporting rates also improved substantially in Ebonyi and Kebbi after activity implementation began, increasing a further 15 percentage points to over 90 percent in Ebonyi and a further 20 points to over 85 percent in Kebbi. In Zamfara, family planning reporting rates improved about another 10 percentage points to 85 percent in March 2022.

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[5] Results presented in June 2022 showed increasing reporting rates, and revised results indicate stronger improvements in DHIS2 reporting. June 2022 results also showed an increase in new FP acceptors in Kebbi and Zamfara and fluctuations in Ebonyi; revised results show fluctuations in each state and do not indicate strong increases in average client loads in Kebbi or Zamfara.

Client Volume

The mean number of new female family planning acceptors per facility fluctuated throughout the study period in each state. As of March 2022, the average client load was approximately 10 patients per facility per month in Ebonyi compared to 14 in Kebbi and Zamfara.

In Ebonyi, the average client load decreased overall until the third quarter of 2019. Client loads then began to increase through the third quarter of 2020, at which point they declined overall until the end of the study period. New female family planning acceptor client loads decreased in Kebbi to a low in the second quarter of 2018; like Ebonyi, client loads then increased to their highest level in the third quarter of 2020, after which they decreased overall until the end of the study. Family planning client loads in Zamfara decreased to their lowest level in the third quarter of 2017, increased to their highest level in January 2020, and then decreased overall until the end of the study period.

Figure 7. Percentage of facilities reporting and average monthly clients: new female family planning acceptors
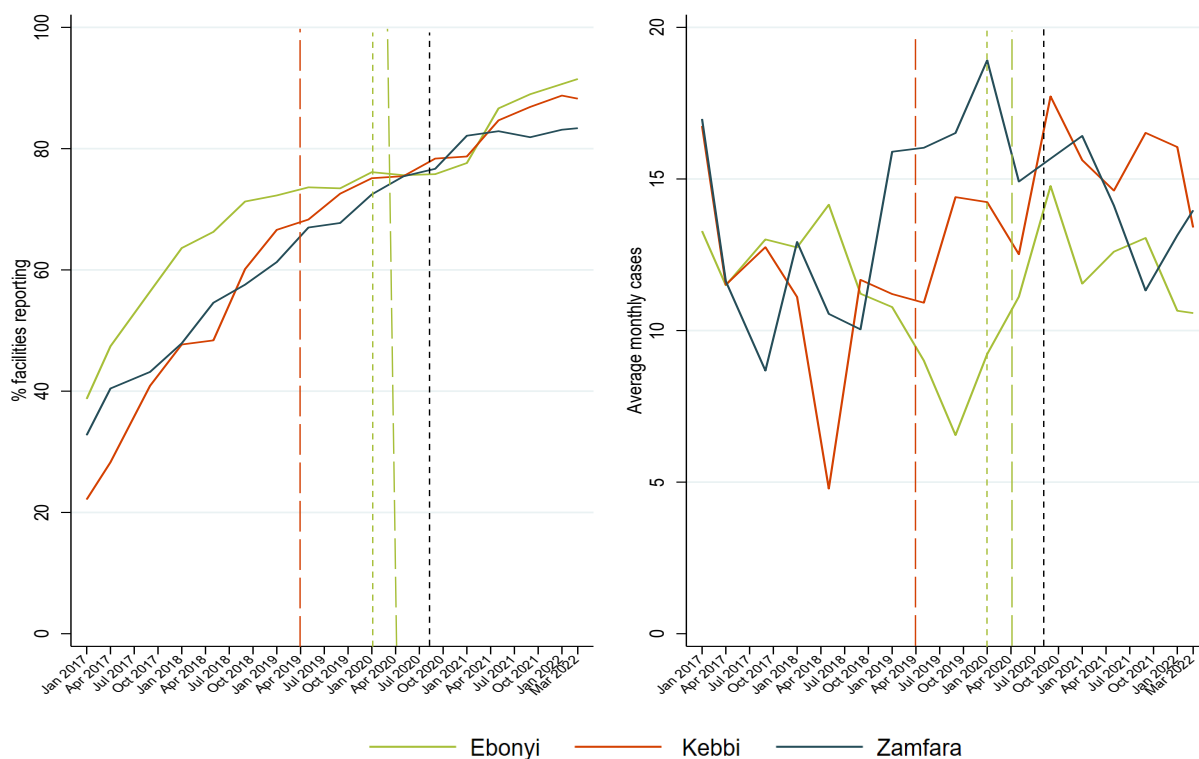
Notes: Dashed vertical lines indicate activity start months by state. The long dashed red line is the April 2019 IHP start date in Kebbi, the short dashed green line is the PMI-S January 2020 start date in Ebonyi, the long dashed green line is the IHP April 2020 start date in Ebonyi, and the short dashed blue line is the August 2020 PMI-S start date in Zamfara.

Conclusions

Study results from the January 2017 – March 2022 period indicate that:

- There were substantial improvements in DHIS2 reporting rates for all health service study variables in all study states.

- Average monthly ANC1, IPTp1, and new female family planning user facility client volumes decreased in all study states.

- Average monthly facility caseloads of persons under-five with fever tested by RDT, with confirmed uncomplicated malaria, and treated with ACT decreased overall during the study period in Ebonyi, remained relatively stable in Kebbi, and increased in Zamfara.

There is not strong evidence overall that the improvements in DHIS2 reporting through March 2022 are linked to the start of the HPN activities because large improvements had already been realized before programming began in each state.

- Nearly all improvement in malaria reporting occurred prior to IHP programming in Kebbi, and most improvement in Zamfara occurred before PMI-S activities began. Health facilities in Ebonyi, where both programming approaches are implemented, realized a 20-percentage point reporting rate increase for pediatric malaria indicators prior to PMI-S and IHP activity start dates and a further 20-percentege point increase after the projects began.

- Most improvements in reporting rates for ANC1, IPTp1, and new female family planning acceptors occurred during the pre-activity period in each state. Continued improvements between activity start dates and the end of the study period were largest in Ebonyi and Kebbi, which both received integrated health programming. Modest improvements were also observed in ANC1 and new family planning user reporting rates in Zamfara after the PMI-S start date; ANC and family planning are not a focus of the PMI-S activity, suggesting reporting gains for these variables could be driven by larger national processes or other health activities in Zamfara.

- Other contributors to DHIS2 reporting rate improvements could include other health projects that preceded or overlapped with the HPN activities and broader changes in the Nigeria HMIS/DHIS2 environment. For example, Zamfara and Ebonyi both received support from USAID's PMI Malaria Action Program for States project from 2010-2016.

Trends in average case and client loads per facility are difficult to interpret in relation to the evaluation question because this initial analysis does not account for differences in population or health service density among states or over time within states. Several different mechanisms could lead to declining average client volumes, and it is not possible to distinguish between them in this analysis.

- Declining average facility case volumes could be related to decreased service demand, decreased service supply within existing facilities, or increased service provision through additional facilities in an environment of relatively stable demand. Many behavioral, cultural, and supply chain factors can also influence facility service volume.

- Monthly health service delivery volumes were likely affected by the COVID-19 pandemic, which would have affected the ability of facilities to receive patients or the willingness of clients to visit health facilities.

Next Steps

This analysis will be expanded to include additional priority indicators and additional months in 2023. Future analyses will also attempt to triangulate DHIS2 service delivery results with population density and geolocated facility data to obtain a more complete understanding of service delivery dynamics over time.

Acknowledgements

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Additional Nigeria HPN Evaluation DHIS2 Resources

Nigeria HPN Multi-Activity Evaluation Baseline DHIS2 Service Utilization Methodology Note (available online at https://www.data4impactproject.org/countries/nigeria)

For more information

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Annex: Data Processing and Completeness

Data Processing

Study data presented a high rate of missing values due to facilities entering the study after January 2017, facilities reporting zero cases or clients per month, which the DHIS2 database treats as missing values, or facilities not reporting for particular periods, which the DHIS2 database also treats as missing values. Pre-analysis data processing occurred in three phases for each of the six health service delivery variables (summarized in Table A1):

1. **Determine the facility's study entry period**. Each facility enters the study during the first month it reports on the variable of interest.[6] The facility does not contribute to the numerator or denominator for either the percent reporting or mean service volume measures for any month before it enters the study.

2. **Replace missing facility-month data with zero value for low-volume facilities that report on at least one other study service delivery variable that month**. Because the DHIS2 database conflates zero values and blank data fields as missing, it is not possible to distinguish true missing values (i.e., no data reported at the facility-month level) from zero values (no service provided at the facility during a month). Low-volume facilities are more likely to have true zero caseloads for a given month, and therefore are more likely to have missing data in the Nigeria DHIS2. To correct for the systematic replacement of zeros as missing data in low-volume facilities, we identified low-volume facilities as those PHCs in which the median number of cases was 25 cases or clients per facility-month or lower. Missing values were replaced as zero values for low-volume facilities in all months where the facility reported data for at least one other study variable; missing values were not replaced for low-volume facilities that were missing all data for the month.

3. **Exclude outliers at the facility-month level from analysis**. Lastly, the internal consistency of reported data for each study variable was assessed. Extreme outliers were defined as monthly values that deviate from the facility's median value by at least 4.5 standard deviations and were excluded from analysis.

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[6] For the purposes of this analysis, it is assumed that a facility does not leave the study (i.e., does not permanently cease reporting to DHIS2, for example due to facility closure).

Table A1. Summary of facility-month data processing approach for each study variable, by indicator

Scenario	Indicator	
	% Facilities reporting service delivery variable x by month m	**State-level average number of cases or clients per facility by month m**
Facility has non-missing, non-outlier data for variable x during month m	Numerator: 1	Numerator: volume
	Denominator: included	Denominator: included
Low-volume facility has missing data for variable x during month m, but reports on other variables during month m	Numerator: 1	Numerator: 0
	Denominator: included	Denominator: included
Low-volume facility does not report data for any study variables during month m	Numerator: 0	Numerator: missing
	Denominator: included	Denominator: not included
Non-low-volume facility has missing data for variable x during month m (missingness of other variables irrelevant)	Numerator: 0	Numerator: missing
	Denominator: included	Denominator: not included
Facility data for variable x in month m identified as extreme outlier	Numerator: 0	Numerator: missing
	Denominator: included	Denominator: not included

Reporting Completeness and Consistency

Table A2 presents a summary of data processing results for all study states by health service variable. Facilities began reporting monthly case and client volumes into the Nigeria DHIS2 at different times throughout the study period, and study entry periods differ among variables. Ninety percent of facilities that report under-five malaria, first ANC visit, and IPTp1 began reporting on these variables during the first study year (2017), compared to 82 percent reporting on new female family planning acceptors.

Facilities were identified as low-volume separately for each of the six study variables. Over 25 percent of facilities reporting under-five fever testing data were identified as low-volume facilities, and 33 percent of facilities that report on under-five confirmed uncomplicated malaria diagnosis and treatment were identified as low-volume facilities for pediatric malaria services. Sixty-four percent of facilities were identified as low-volume for ANC first visit, and three-fourths were identified as low-volume facilities for IPTp1 and new female family planning services.

The number of non-missing facility-months each facility contributes to the study varies by variable and when the facility began reporting variable-specific data. Of all facility-months included in the study (i.e., all facility-months after the facility began reporting variable data), between three to seven percent were missing data points that were replaced as zero values for low-volume facilities for the three pediatric malaria variables. In comparison, approximately 15 percent of ANC first visit and IPTp1 facility-month values and over 20 percent of female family planning acceptor facility-month values were missing values that were replaced with zeros for low-volume facilities. The percentage of study facility-month observations that were identified as extreme outliers and excluded from analysis ranged from 1.4 percent to 2.0 percent across study variables.

Table A2. Description of overall facility reporting, study entry, low-volume classification, missing data replacement, and outliers

Health Service Indicator	%All study PHC facilities (N=2,284) ever reporting	% Facilities that began reporting in 2017	% Facilities identified as low-volume	% Facility-months replaced as 0	% Facility-months excluded as outliers
Persons presenting with fever & tested by RDT, under 5 years	96.8	90.7	26.4	5.7	1.7
Persons with confirmed uncomplicated Malaria, under 5 years	96.2	90.7	32.9	3.2	1.5
Persons with confirmed uncomplicated Malaria treated with ACT, under 5 years	96.2	91.2	33.0	7.3	1.4
1st ANC visit	66.3	91.1	64.0	15.2	2.0
ITPp1	66.7	89.1	74.4	15.6	1.4
New female family planning acceptors	70.4	82.2	78.5	24.0	1.5

Notes: State-level information by study year is available in the Nigeria HPN Multi-Activity Evaluation Baseline DHIS2 Service Utilization Methodology Note. The denominator for the last two table columns (% facility-months replaced as zero and % facility-months excluded as outliers) includes all facility-months after the facility enters the study, including missing data not replaced as zeros.