

1 **Supplemental Information**

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3 **Use of supervision data to improve quality of care for malaria in pregnancy:**
4 **experience in six African countries**

5 Running head: supervision data for improved care for malaria in pregnancy

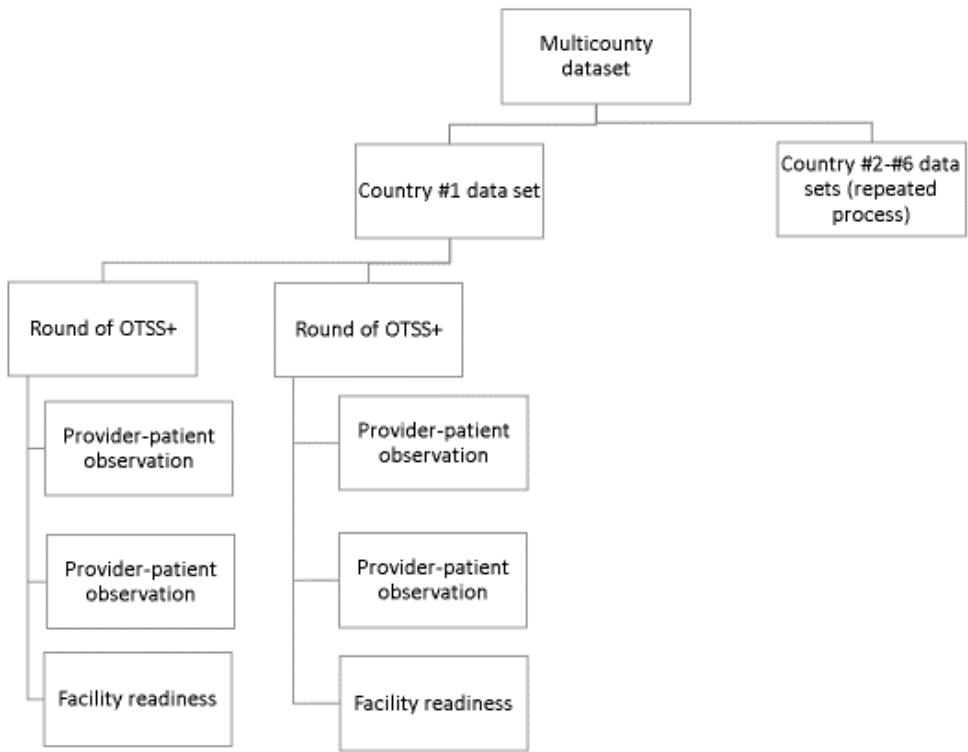
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29 Supplement Figure S1. Overview of OTSS+ data collection and aggregation process.



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31 Supplement Table S1. Rounds and sum of observations of OTSS+ data used in the MiP QoC.

| Country | Rounds of data | Total observations | Observations by competency score |
|----------------|------------------------------|---------------------------|---|
| Cameroon | Nov–Feb 2020 Aug–Sep 2020 | 339 | Prevention: 226 Treatment: 94 RMC: 333 |
| Cote d’Ivoire | May–Aug 2020 Sep–Dec 2020 | 284 | Prevention: 218 Treatment: 86 RMC: 284 |
| Ghana | Jan–May 2019 Sep–Dec 2020 | 951 | Prevention: 944 Treatment: N/A RMC: 898 |
| Kenya | Sep–Dec 2019 Oct–Dec 2020 | 82 | Prevention: 81 Treatment: 81 RMC: 81 |
| Mali | Mar–Jun 2020 Jul–Oct 2020 | 595 | Prevention: 287 Treatment: 283 RMC: 595 |
| Niger | Jun–Jul 2020 Nov–Dec 2020 | 193 | Prevention: 193 Treatment: 193 RMC: 193 |

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33 Supplement Table S2. Outline of variables used in regressions.

| Objective | Dependent variables | Explanatory/independent variables | Controlled variables |
|---|----------------------------|--|---|
| The effect of availability of essential commodities on overall competency of the provider in offering MiP services | MiP prevention score | SP availability, ITN availability | The other prevention stock variable held constant |
| | MiP treatment score | Quinine availability, ACT availability, injectable artesunate availability | The other treatment stock variables held constant to examine specific commodities |
| The effect of directly observed therapy (DOT) supplies (drinking water and cups), training, cadre, facility type, provider gender, and availability of job aids on provider competency in delivery of MiP prevention services | MiP prevention score | Recent training, gender of health worker, availability of DOT supplies (drinking water and cups), availability of job aids, cadre of health worker, health facility type | SP stock availability |
| The effect of training, cadre, facility type, | MiP treatment score | Recent training, gender of health worker, availability | ACT stock |

| | | | |
|--|------------------|---|---|
| <p>provider gender, and availability of job aids on provider competency in delivery of MiP treatment services</p> | | <p>of job aids, cadre of health worker, health facility type</p> | <p>availability</p> |
| <p>The effect of training, cadre, facility type, provider gender, availability of MiP guidelines on provider competency in delivery of RMC</p> | <p>RMC Score</p> | <p>Recent training, gender of health worker, availability of job aids, cadre of health worker, health facility type</p> | <p>SP stock availability and ACT stock availability</p> |

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36 Supplement Table S3. Components of MiP prevention competency scores.

| Dispensing IPTp | |
|------------------------|---|
| 1 | Did the worker greet the woman at the entrance of the consultation office? |
| 2 | Did the worker invite the woman to sit down? |
| 3 | Did the worker introduce himself/herself to the woman? |
| 4 | Did the worker ask where the woman lived? |
| 5 | Did the worker ask the woman's age? |
| 6 | Does the worker treat the woman with kindness and respect throughout the visit? |
| 7 | Did the worker ask or investigate whether the pregnant woman was at her first ANC? * |
| 8 | Did the worker ask about or look for or determine the gestational age (date of last menses, fundal height, sonography) ANC record, pregnancy record)? * |
| 9 | Did the worker look for a sign of malaria or ask about a history of fever over the two previous days? And whether the patient presented a fever or not) |
| 10 | Did the worker conduct a malaria test (rapid diagnostic tests or microscopy) |
| 11 | Did the worker ask or investigate whether the pregnant woman had taken SP in IPTp over the previous four weeks? |
| 12 | Did the worker check (mother-child record) whether the woman was on co-trimoxazole for HIV chemoprevention? |
| 13 | Has the health worker verified that the pregnant woman is eligible for IPTp during this CPN (gestational age of at least 13 weeks and not having had SP in the previous 4 weeks and |

| | |
|--------------------------|--|
| | without co-trimoxazole treatment for HIV prophylaxis)? * |
| 14 | Did the health worker made the woman aware of the consequences of malaria on pregnancy outcome? |
| 15 | Did the health worker make the woman aware of the benefits of preventing malaria with SP? * |
| 16 | Did the health worker educate the woman about the need to take at least three doses of SP before giving birth? |
| 17 | Has the health worker informed the woman about the potential side effects of SP? * |
| 18 | Did the health worker give three SP tablets to the pregnant woman eligible for IPTp? * |
| 19 | Did the health worker ask the woman to drink water to swallow the three SP tablets on the spot? * |
| 20 | Did the health worker observe the woman taking the three SP tablets? * |
| 21 | Did the health worker ask the woman to return each month for ANC/IPTp until delivery? |
| 22 | Has the health worker asked the woman to return to see him/her if there are any serious skin and/or digestive symptoms as a result of taking the SP? * |
| 23 | Has the health worker informed the pregnant woman of the date of the next appointment? * |
| 24 | Has the health worker recorded the dose of SP in the mother-child record and CPN registry in compliance with the guidelines? * |
| LLIN Distribution | |
| 25 | Did the worker explain the benefits of sleeping under an LLIN every night to prevent malaria? |
| 26 | Did the health worker give the woman an LLIN if she had not yet received it during this |

| | |
|------------------------------------|---|
| | pregnancy? |
| 27 | Did the worker explain to the woman how to use the LLIN? |
| 28 | Did the health worker advise the pregnant woman to sleep under LLINs during pregnancy and after delivery with her newborn baby? * |
| 29 | Has the worker recorded the distribution of the LLIN to the woman in the mother-child record and in the appropriate register? |
| Dispensing antianemia drugs | |
| 30 | Did the worker give the woman iron tablets after the consultation? |
| 31 | Did the worker give the woman 0.4 mg folic acid tablets after the consultation? |
| 32 | Did the worker check that the woman understood how to take the iron and folic acid tablets? |

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39 Supplement Table S4. Components of MiP treatment competency scores.

| Malaria Diagnosis | |
|-------------------------------|---|
| 33 | Did the worker explain the result to the woman? |
| 34 | Did the health worker ask questions looking for signs of severe malaria (convulsions, agitation, confusion, prostration, etc.)? |
| 35 | Did the worker ask if the patient has taken any malaria treatment in the last two weeks? |
| 36 | Did the health worker ask about any drugs already taken by the woman? |
| 37 | Did the worker take the temperature? |
| 38 | Did the worker measure [the patient's] weight? |
| 39 | Did he/she take her blood pressure? |
| 40 | Did the worker take a pulse/respiratory rate? |
| 41 | Did the worker check for fetal heart sounds (2nd and 3rd trimester of pregnancy)? |
| 42 | Did the health worker look for signs of anemia in the woman (pallor of the conjunctivae/palms of hands)? |
| 43 | Did the health worker look for signs of other serious illnesses (meningitis, encephalitis, etc.)? |
| 44 | Did the worker categorize the type of malaria according to national guidelines? |
| Antimalarial Treatment | |
| 45 | If it is uncomplicated malaria , does the antimalarial drug used to treat the pregnant woman comply with the guidelines? |

| | |
|----|---|
| 46 | Did the worker use the correct dosage to treat uncomplicated malaria in pregnant women? |
| 47 | Is the dosage and duration of treatment explained to the woman? |
| 48 | Did the worker verify that the woman understood the explanations given? |
| 49 | Did the worker inform the woman of the potential undesirable effects of the drug used? |
| 50 | Did the worker invite the woman to come back if she has complications? |
| 51 | Did the worker give the woman and her family appropriate advice on malaria (causes, risks, prevention)? |
| 52 | Did the worker give the woman a follow-up appointment? |
| 53 | Did the worker enter information on the treatment into the register? |
| 54 | If it is severe malaria , did the worker administer any pre-transfer treatment? |
| 55 | Does the compound used for pre-transfer treatment of severe malaria in pregnant women comply with the guidelines? |
| 56 | Did the worker record all the information collected from the woman in his register? |
| 57 | Has the woman and/or her family received appropriate malaria counselling? |

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42 Supplement Table S5. Respectful Maternity Care calculations.

| Country | RMC score calculation: <i>Average of the following data elements</i> |
|----------------|--|
| Cameroon | <ul style="list-style-type: none"> ● Did the provider greet the woman? ● Does the provider treat the woman with kindness and respect? ● Was the patient and family welcomed/invited to sit down? ● Did the health worker encourage the client to ask questions? |
| Cote d'Ivoire | <ul style="list-style-type: none"> ● Did the provider greet the woman at the entrance of the counselling office? ● Did the provider invite the woman to sit down? ● Did the provider introduce themselves to the woman? ● Does the provider treat the woman with kindness and respect? ● Did the provider offer the woman the opportunity to ask questions? |
| Ghana | <ul style="list-style-type: none"> ● Was the pregnant woman welcomed? |
| Kenya | <ul style="list-style-type: none"> ● Was the client encouraged to ask questions and were questions answered? |
| Mali | <ul style="list-style-type: none"> ● Was the woman welcomed with respect and kindness? ● Did the provider ask if the pregnant woman had any questions? |
| Niger | <ul style="list-style-type: none"> ● Did the provider greet the woman at the entrance of the counselling office? ● Did the provider invite the woman to sit down? ● Did the provider introduce themselves to the woman? ● Did the provider treat the woman with kindness and respect? ● Did the provider offer the woman the opportunity to ask questions? |

44 Supplement Table S6. Classification of health facility types by country.

| | Dispensary | Health Center | Hospital |
|----------------------|-------------------|--|--|
| Cameroon | N/A | <i>Centres de sante integres, centres medicaux d'arrondissement, clinique privee</i> | <i>Hôpitaux de district, hopitaux regionaux et assimilés</i> |
| Cote d'Ivoire | Maternité rurale | <i>Centre de santé rurale, centre de sante urbain, centre de sante urbain spécialisé</i> | <i>Hospital general, centre hospitalier regional</i> |
| Ghana | CHPS | Clinics, health centers | Hospitals, medical centres, polyclinics |
| Kenya | Dispensaries | Health centers | Sub-county hospitals, hospitals |
| Mali | N/A | <i>Centre de santé communautaire, centre de sante de référence</i> | N/A |
| Niger | N/A | <i>Centre de santé intégré</i> | N/A |

45 Supplement Table S7. Job aid, training, and DOT supplies indicator language by country.

| | Job Aid Availability | Training data | DOT supplies |
|----------|--|--|---|
| Cameroon | <p>Are the malaria and pregnancy guide or tools and/or support on ANC available in the facility/</p> <p>Are the ANC guidelines available today/ Are the ANC guidelines, including the long-lasting insecticidal nets (LLINs), available in the facility on the day of supervision/ Is the guide for the management of malaria in pregnant women available today in the health facility</p> | <p>Have you received training on the national malaria control program’s guidelines</p> | <p>Is drinking water available to administer SP/ Drinking water at the ANC site/ Are the cups for administering SP during the DOT available/ Disposable cups for the DOT strategy</p> |
| CDI | <p>Are the malaria and pregnancy guide or ANC tools and/or support available/ Are the ANC guidelines available</p> | <p>Have you received training on the national malaria control program’s guidelines</p> | <p>Drinking water at the ANC site/ Disposable cups for SP DOT strategy during ANC</p> |

| | | | |
|-------|--|---|---|
| Ghana | MiP Guidelines Available | Formal training MiP past 6 months/On-the-job training MiP Past 6 months | Is clean water available for directly observed therapy (DOT) of SP at the antenatal care unit |
| Kenya | Prevention of malaria in pregnancy poster/job aid | N/A | Cups or other drinking devices/Available clean drinking water |
| Mali | Availability of memory aids on the MiP in the maternity ward | The supervised health worker has received training in MiP within the past 2 years | Availability of potable water and clean cups in the ANC room for supervised SP intake in the ANC room |
| Niger | Are the malaria and pregnancy guide or tools/support on ANC available/Are the National Malaria Management Guidelines available | N/A | Disposable Glasses for SP DOT Strategy/Drinking water at the ANC site |

47 **Supplementary Text. Country Validation Meeting Findings**

48 Country data validation meetings were held after the completion of data analysis and yielded qualitative
49 information about data collection, the health system, and the supervision process to contextualize
50 country-specific findings of the data analysis. Country-specific results from the validation meetings are
51 as follows:

52 **Cameroon**

53 The discussion focused on the findings around MiP prevention competency and ITN availability, and
54 health worker cadre. The negative correlation between ITN availability and MiP prevention competency
55 was attributed to data quality challenges. The team found the correlations between competency and
56 health worker cadre unsurprising. In Cameroon, nurse assistants often have many more years of
57 experience than nurses. Midwives benefit from more in-depth, pregnancy-focused training. The
58 Cameroon team confirmed that more nurses have been trained on MiP and case management since the
59 supervision visits included in the analysis occurred.

60 **Cote d'Ivoire**

61 The discussion with the Cote d'Ivoire team also focused on understanding and responding to difference
62 in competency between cadres and genders; however, in Cote d'Ivoire, nurses and male health workers
63 were observed to have higher competencies than midwives and female health workers. The team
64 confirmed that most nurses are male and most midwives are female. They also noted that nurses tend
65 to work in more rural, smaller health facilities while midwives tend to work in larger, more urban
66 facilities that have a larger staff. When trainings are held, each facility is offered a small number of seats
67 in the training. The result is that all providers in smaller facilities are trained, while only some of the
68 providers in larger facilities are trained. The team noted that a shift to more on-the-job training could
69 address this issue by reaching a larger number of providers.

70 **Ghana**

71 The Ghana dataset contains the largest number of observations compared to the other countries in the
72 analysis. As such, the results from Ghana may be the most representative, generalizable, and robust.
73 These results may be most likely to illuminate relationships between the outcome variables and
74 independent variables, should these relationships exist. SP availability, ITN availability, and DOT supplies
75 have the largest relationship with competency, followed by training. Therefore, investments in these
76 areas may have the largest impact on competency.

77 **Kenya**

78 Kenya's OTSS+ process is considered mentorship, as the national supportive supervision process does
79 not include observation of competency but primarily assesses facility readiness and health worker
80 knowledge of the national malaria guidelines. Because the sample size was small, non-significant
81 relationships **were** identified; however, several regressions seemed indicative of trends worth noting.
82 MiP prevention competency scores were 5.5 percentage points higher when job aids were available.
83 Conversely, the presence of quinine correlated negatively (though non-significantly) with MiP treatment
84 competency, with a 16.6 percentage point reduction in competency score. The country team noted that
85 quinine stock levels had been low, so providers were likely using ACTs, which may lead to this negative
86 relationship. (According to WHO treatment guidelines, this practice is acceptable in the absence of
87 quinine.)

88 **Mali**

89 Mali noted several commodity-related challenges that may have contributed to the lack of significant
90 positive correlation between stock availability and competence. In some cases, pregnant women may be
91 charged for SP, as also happens for ACTs. In addition, private sector facilities (which were included in the
92 OTSS+ supervision) often experience stock-outs of malaria commodities. The Mali team expressed an
93 interest in a future sub-analysis comparing public and private sector facilities' MiP service competencies
94 to better differentiate and tailor support. The Mali team noted that the data analyzed were collected

95 before widespread trainings were carried out. The country team noted that previously, providers were
96 more comfortable using quinine for treatment of severe MiP.

97 **Niger**

98 The country team noted the negative but non-significant correlation between having SP stock available
99 and MiP prevention competency. The team noted that DOT supplies in Niger remain a challenge, with
100 observed DOT supply availability at 43%. When drinking water is not available, pregnant women are
101 given SP and encouraged to take it at home. While IPTp may be recorded as administered, it's difficult to
102 know whether the tablets were ever taken. There have been efforts to encourage women to bring
103 drinking water to ANC to facilitate taking SP at the facility. In addition, efforts have been made to
104 reorganize patient flow through the facility so a staff member can confirm that the SP was taken as the
105 woman exits the facility.

106 The country team shared that they had noted after the first round of OTSS+ many midwives were not
107 trained, as training preference was given to nurses. The team addressed this and since has increased the
108 number of trained midwives. The team noted an improvement in competency following the increase in
109 trained providers.