Clinical Outreach Training and Supportive Supervision Quality-of-Care Analysis: Impact of Readiness Factors on Health Worker Competencies in Malaria Case Management in Cameroon, Mali, and Niger

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Abstract. Improving the quality of malaria clinical case management in health facilities is key to improving health outcomes in patients. The U.S. President’s Malaria Initiative Impact Malaria Project has supported implementation of the outreach training and supportive supervision (OTSS) approach in 11 African countries to improve the quality of malaria care in health facilities through the collection and analysis of observation-based data on health facility readiness and health provider competency in malaria case management. We conducted a secondary analysis of longitudinal data collected during routine supervision in Cameroon (April 2021–March 2022), Mali (October 2020–December 2021), and Niger (November 2020–September 2021) using digitized checklists to assess how service readiness affects health worker competencies in managing patients with fever correctly and providing those with confirmed uncomplicated malaria cases with appropriate treatment and referral. Linear or logistic regression analyses were conducted to assess the effect of facility readiness and its components on observed health worker competencies. All countries demonstrated significant associations between health facility readiness and malaria case management competencies. Data from three rounds of OTSS visits in Cameroon, Mali, and Niger showed a statistically significant positive association between greater facility readiness scores (including the availability of commodities, materials, and trained staff) and health worker competency in case management. These findings provide evidence that health worker performance is likely affected by the tools and training available to them. These results reinforce the need for necessary tools and properly trained staff if high-quality malaria case management services are to be delivered at health facilities.

INTRODUCTION

In the face of numerous challenges to malaria control and elimination efforts, the WHO has reiterated the importance of using a primary health-care approach to strengthen health systems so that high-quality services and interventions can be delivered to and accessed by those in need. Improving the quality of malaria clinical case management in health facilities through timely and accurate diagnosis and treatment of confirmed cases using artemisinin-based combination therapies (ACTs) is key to improving health outcomes in patients. There is considerable evidence demonstrating the positive impact of training and supportive supervision on improving provider practices.

The U.S. President’s Malaria Initiative (PMI) Impact Malaria Project, launched in 2018, has supported implementation of the outreach, training, and supportive supervision (OTSS) approach to improve the quality of malaria care in health facilities in 11 African countries (Cameroon, Côte d’Ivoire, Ghana, Kenya, Madagascar, Malawi, Mali, Niger, Sierra Leone, Tanzania, and Zambia). This approach, built on the original OTSS approach launched under the PMI Improving Malaria Diagnostics Project (2007–2011) and continued under the PMI MalariaCare Project (2012–2017), focuses on the continuous improvement of 1) service delivery readiness of health facilities, and 2) competencies of health providers in malaria diagnosis and treatment. Outreach, training, and supportive supervision

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observe the provider–patient interaction, collecting information on the competency of health workers in welcoming patients, assessing the history of fever, reviewing symptoms, performing a physical examination, requesting appropriate testing (including RDTs), making the correct classification of cases (as nonmalaria, uncomplicated malaria, or severe malaria), providing treatment to patients with positive tests, adhering to negative test results, and providing counseling to patients. This checklist generates data on the overall performance of health workers, as well as for each of the component behaviors.

Previous studies have assessed the impact of facility readiness on the implementation of malaria interventions. Evidence from cross-sectional studies in particular have demonstrated the correlation between facility readiness and quality service delivery. Similarly, the service availability and readiness assessment methodology has provided information on the availability of health system inputs and their impact on improved health outcomes. However, there remains a paucity of evidence on the direct impact of these inputs, or facility readiness more generally, on the quality of malaria case management. The study showed a strong positive association between overall performance and key readiness outputs (such as the availability of the most recent malaria case management guidelines and algorithms, and formally trained health workers), but found no significant association between stock-outs of ACTs and health worker competency scores. However, the study did not explore the direct association between the availability of commodities and the specific competencies of health workers in requesting RDTs and prescribing the correct malaria treatment. The study team noted the need for additional evidence on the association between health facility readiness and the quality of malaria case management.

This secondary analysis of OTSS data assesses whether health facility readiness in high-burden countries is associated with health worker competencies in diagnosing and managing patients correctly who are suspected of having malaria, and providing those with uncomplicated malaria with appropriate treatment and referral.

**MATERIALS AND METHODS**

A secondary analysis of longitudinal OTSS data collected during routine supervision activities in Cameroon, Mali, and Niger was conducted to assess the association between overall facility readiness and the competency of health workers in managing patients suspected of having malaria, in addition to the association between 1) the availability of trained personnel in facilities and the competency of health workers in assessing fever correctly, including requesting a malaria diagnostic test (microscopy and/or RDTs) and providing the correct treatment for patients diagnosed with malaria; 2) the availability of guidelines, documents, and materials in facilities and the competency of health workers in assessing fever correctly, including requesting malaria tests (microscopy and/or RDTs) and providing the correct treatment for patients diagnosed with malaria; 3) the availability of RDTs and microscopy commodities in facilities and the competency of health workers in requesting a malaria diagnostic test for patients with fever; and 4) the availability of first-line malaria treatment and the competency of health workers in prescribing the correct treatment.

**Study design.** Three countries—Cameroon, Mali, and Niger—were selected for this study because of the similarities in their implementation of OTSS: 1) all started OTSS in 2019; 2) all used the same OTSS tool and checklists, with slight adaptations for country context; and 3) all made similar investments and faced similar challenges in policy development, training, and supply chains for commodities such as RDTs and ACTs. At the time of the study, five rounds of OTSS had been implemented in Cameroon, Mali and Niger since its launch in 2019. A round is defined as a specific period during which a targeted set of facilities receive OTSS visits. The OTSS rounds should happen quarterly in each of the three countries. However, constraints—which are linked primarily to competing government priorities—resulted in each of the countries conducting OTSS rounds every 4 to 6 months. At the launch of this approach, the number of facilities to visit was selected based on PMI Impact Malaria target facilities according to availability of resources. Over time, the initial pool of facilities was increased gradually based on the expansion of Impact Malaria targets.

Three rounds were selected for each country. Rounds 3 through 5 were selected for Cameroon and Mali. For Niger, rounds 2 through 4 were selected because, starting in round 5, OTSS visits shifted to a different set of facilities that had not been visited in previous rounds, making the results from round 5 not comparable to previous rounds. The specific timing of each round is noted in Table 1.

Supervisors use digitized checklists that break down the recommended procedures into objective steps (with yes/no questions to indicate whether a step was performed) and are provided periodic refresher training to limit observer bias. Each question in the checklists is assigned a weight of

<table>
<thead>
<tr>
<th>Table 1: Number of facilities and observations in final data sets for Cameroon, Mali, and Niger</th>
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<tbody>
<tr>
<td><strong>Country</strong></td>
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<tr>
<td>Cameroon</td>
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<tr>
<td>Mali</td>
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<td>Niger</td>
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1 to 3 points based on its importance. In addition, data collected during the observation are reviewed and validated with the observed health provider.

Supervision data collected in the HNQIS (version 1.6.15; Population Services International, Washington, D.C.) and downloaded to a DHIS2 (version 2.36.10.1; University of Oslo, Norway) platform were extracted. Data from each OPD checklist from a round of OTSS visits in a country were matched with the corresponding facility readiness checklist. If there were multiple facility readiness checklist observations for the same facility on the same date, which could have resulted from multiple entries by the supervisor, the observation with the lowest score was retained. All observations for the OPD checklist were retained because countries perform as many as three clinical observations during one OTSS visit. Facilities with data available from both the facility readiness and the OPD checklists within each round were included in the study.

**Measures and variables.** We selected four variables from the OPD checklist (dependent variables) and five variables from the facility readiness checklist (independent variables) for analysis. Variables selected from the OPD checklist included case management competency score, correct classification of malaria, malaria test requested for a child with fever, and malaria treatment provided for a child who tested positive for malaria. Variables selected from the facility readiness checklist included overall readiness score, percentage of facilities with ≥ 50% of health workers who received classroom training, availability of materials, availability of RDTs, and availability of ACTs.

A competent health worker is defined as one who achieved an overall competency score of 90% on the OPD checklist, which is calculated using all sections of the checklist, including patient assessment, diagnosis, classification, and correct treatment and referral based on RDT result. The case management competency score data were retained as a continuous variable.

Facility readiness is defined as a health facility that achieved an overall readiness score of 90% on the facility readiness checklist, which is calculated using all sections of the checklist, including the availability of malaria commodities, materials, documentation, and ≥ 50% of personnel receiving classroom training. Our study looked at the availability of two commodities—RDTs and ACTs—as binary variables, where 0 = no commodity available and 1 = the commodity was available. The availability of ACTs was defined by the availability of ACT for all age groups across each country. (In Cameroon, a minimum 1-month supply was required.) In instances where ACTs were not available for a certain age group, ACTs were considered not to be available. Availability of materials is defined as a facility that scores ≥ 90% in having national malaria guidelines and recommended job aids, as well as necessary malaria registers and reporting forms, per the national guidelines. Our study retained the availability of materials variable as a continuous variable. Facilities with the necessary personnel is defined as those with ≥ 50% of their personnel (all categories) having received classroom training in malaria case management during the past 2 years.

**Analyses.** The study team first calculated for each country the average health facility readiness and health worker competency scores for all facilities and the proportion that met the 90% threshold score for health facility readiness and health worker competency in case management. In addition, for health facility readiness, the proportion of health facilities that have ≥ 50% of trained health workers, RDTs available, and ACTs available was calculated, as was the average score of health facilities that have the necessary materials (sum of availability of materials scores divided by the number of facilities). For health worker competency, the proportion of the health workers that classify malaria correctly, request a malaria test, and provide the correct treatment was generated.

Linear regressions assessed the percentage point change in case management competency score (dependent variable) with each 10% increase in overall readiness score (independent variable), the percentage point change in case management competency score (dependent variable) with each 10% increase in materials availability (independent variable), and the percentage point change in case management competency score (dependent variable) when facilities have ≥ 50% of trained personnel (independent variable).

Logistic regressions were conducted to assess the odds of the health worker providing correct treatment to patients (dependent variable) with the availability of ACTs (independent variable), and the odds of the health worker requesting RDT or microscopy (dependent variable) with the availability of RDT commodities (independent variable). Statistical regressions were deemed significant at $P < 0.05$.

**Data management.** Location data such as GPS points were not included in extracted data sets. Facility names were included in the data sets but were not used for the analysis. Analyses and results were only presented at the country level, with aggregate data to ensure results did not contain any personally identifiable information and could not be traced back to a particular individual, facility, or geographic area in-country. All data were stored in a restricted access folder.

**Data validation.** The research team held a validation meeting with PMI Impact Malaria country teams in November 2022 to review preliminary findings for their respective country. During the validation meeting, the research team presented and discussed the findings and relevant contextual information.

**RESULTS**

The final data sets used for analysis included a total of 895 observations for Cameroon, 1,286 observations for Mali, and 284 observations for Niger. Details on the number of observations and facilities for each round and country are outlined in Table 1.

Table 2 presents trends in scoring over successive OTSS rounds for the variables chosen for the linear or logistic regression analyses for Cameroon, Mali, and Niger. In the three countries, health workers demonstrated an improvement in case management competency scores through the three rounds analyzed (Figure 1). The percentage of health facilities that achieved a ≥ 90% overall facility readiness score increased with subsequent OTSS visits across all countries. In Cameroon, the percentage of health facilities that met this 90% threshold increased from 7.9% in round 3 to 60.4% in round 5. In Mali, the percentage that met the threshold increased from 33.1% in round 3 to 41.7% in round 5. Niger also showed an increase in the percentage that met the threshold, from 5.7% in round 2 to 29.2% in round 4. In most instances, commodity and material
TABLE 2
Health facility readiness and health worker competency for Cameroon, Mali, and Niger across three rounds of outreach training and supportive supervision

<table>
<thead>
<tr>
<th>Country</th>
<th>Round</th>
<th>Health Facility Readiness</th>
<th>Health Worker Competency</th>
</tr>
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<tbody>
<tr>
<td>Cameroon</td>
<td>R3</td>
<td>215 (7.9)</td>
<td>211 (10.4)</td>
</tr>
<tr>
<td></td>
<td>R4</td>
<td>395 (21.0)</td>
<td>394 (16.6)</td>
</tr>
<tr>
<td></td>
<td>R5</td>
<td>285 (60.4)</td>
<td>285 (18.9)</td>
</tr>
<tr>
<td>Mali</td>
<td>R3</td>
<td>480 (33.1)</td>
<td>475 (37.9)</td>
</tr>
<tr>
<td></td>
<td>R4</td>
<td>384 (40.6)</td>
<td>386 (46.0)</td>
</tr>
<tr>
<td></td>
<td>R5</td>
<td>374 (41.7)</td>
<td>396 (45.6)</td>
</tr>
<tr>
<td>Niger</td>
<td>R2</td>
<td>106 (5.7)</td>
<td>109 (100.0)</td>
</tr>
<tr>
<td></td>
<td>R3</td>
<td>79 (31.6)</td>
<td>89 (100.0)</td>
</tr>
<tr>
<td></td>
<td>R4</td>
<td>96 (29.2)</td>
<td>76 (100.0)</td>
</tr>
</tbody>
</table>

**Descriptive statistics**

R3 = round 3; R4 = round 4; R5 = round 5

- **Health facility readiness**
  - Health facilities that have a 90% score for overall readiness
  - Health facilities that have 50% of trained health workers
  - Average score of health facilities that have the necessary materials
  - Health facilities that have RDTs available
  - Health facilities that have ACTs*

- **Health worker competency**
  - Health workers who have a 90% score for competency
  - Health workers who classified malaria correctly
  - Health workers who requested a malaria test
  - Health workers who provided the correct treatment

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* The ACT variable was calculated in a binary way (0/1) as 1 if all age groups had ACTs available and 0 if at least one age group did not have ACTs available.

† Amalaria test was used as an RDT or microscopy. Because of indicator wording, RDT and microscopy could not be disaggregated.

‡ The variable for providing the right treatment was split into two categories: for pregnant women or for nonpregnant women. Except for Cameroon round 3, all data for nonpregnant women were used.

§ Nonpregnant women.

This study is one of the first to assess the association between facility readiness factors and competency in malaria availability, correct classification of malaria, requesting a malaria test, and providing correct treatment to patients.
### Table 3

Association between provider competency and health facility readiness in Cameroon, Mali, and Niger over three rounds of outreach training and supportive supervision

<table>
<thead>
<tr>
<th>Descriptive statistic</th>
<th>Cameroon</th>
<th>Mali</th>
<th>Niger</th>
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<tbody>
<tr>
<td>Percentage change in case management competency score (y) with each 10% increase in overall readiness score (x)</td>
<td><strong>3.7 (1.9–5.4)</strong>†&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>4.8 (3.7–5.9)</strong>†&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>2.2 (1.3–3.2)</strong>†&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Percentage change in case management competency score (y) with each 10% increase in materials available (x)</td>
<td><strong>2.1 (1.3–2.9)</strong>†&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>2.4 (1.8–3.0)</strong>†&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>0.3 (-0.1 to 0.6)</strong></td>
</tr>
<tr>
<td>Percentage change in case management competency score (y) when facilities have ≥ 50% trained personnel (x)</td>
<td><strong>2.4 (-1.0 to 5.9)</strong></td>
<td><strong>0.6 (-1.6 to 2.7)</strong></td>
<td><strong>4.3 (-0.1 to 8.8)</strong></td>
</tr>
</tbody>
</table>

<sup>*</sup>P < 0.001.  
<sup>†</sup>P < 0.01.  
<sup>‡</sup>P < 0.05.  
Values in bold type are statistically significant.
cases correctly as uncomplicated or severe, and providing the correct treatment to patients diagnosed with malaria.

There were some limitations to our analysis. In some instances, the sample sizes were too small to run a regression analysis. In others, the lack of diversity of data between variables, particularly when the competency scores were high for some indicators, limited the ability to assess some associations. Artemisinin-based therapy availability was collected as a binary variable and was disaggregated by four age groups. The study team had to calculate manually an estimated aggregated ACT availability variable, which may have introduced some inaccuracies during the aggregation process. The limited sample size also prevented multivariable regression analysis to test for confounding effects and have more conclusive results for some variables, such as the impact of readiness adherence to a negative RDT.

Our study provides further evidence that strengthening and sustaining health facility readiness is an important input toward improving the quality of malaria case management. Based on our results, health facility readiness should be an essential component of a systems-based, integrated, and tailored approach for improving the quality of malaria services in high-burden countries. In addition, the analyses presented herein should be embedded into regular programmatic assessments on quality-of-care trends using well-defined indicators at all levels to allow corrective actions when and where gaps are identified.

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