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

Yves-Marie Bernard,1 Jehan Ahmed,1 Jadmorn Mostel,1 Thierno Ba,1 Annie Coriolan Ciceron,1 Moses Busiga,1 Aissata Koné,2 Beh Kamato,3 Fatoumata Sidibé,3 Chebou Diallo,3 Alzouma Makayi,4 Daniel Christian Koko,5 Arouna Djibrillia,5 Joëlle Ateba,6 Eric Tchinda Meli,7 Christophe Tchadjeu,8 Kevin Griffith,9 Jordan Burns,9 and Lawrence M. Barat1*


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.1 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.2–5 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).6 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),7,8 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 Supervisors use standard checklists to monitor and track progress by conducting a facility inventory and by observing health workers managing patients directly.

In most countries, OTSS checklist data are collected in the Health Network Quality Improvement System (HNQIS), a digital platform that provides immediate scoring during the OTSS visit. Based on these scores, supervisors provide on-the-job training, coaching, and troubleshooting, and develop action plans to address identified gaps. The OTSS visit results and action plan are followed up between visits to address gaps in the availability of essential malaria drugs and commodities, materials (e.g., job aids and guidelines), and documentation (i.e., registers and reporting forms); and are reinforced during subsequent visits to strengthen continuously health worker competencies to manage malaria cases (including malaria in pregnancy) and perform malaria rapid diagnostic tests (RDTs) properly.

The OTSS readiness checklist (Supplemental Figure 1) collects facility-based information on the availability of malaria commodities, including RDTs and ACTs; materials, including malaria case management guidelines and job aids; documentation (registers and reporting forms); and trained personnel at the facility. The information gathered from the readiness checklist during OTSS visits enables supervisors to track progress on overall facility readiness and each individual checklist component.

The OTSS approach also uses a health provider competency-based checklist—the outpatient department (OPD) checklist (Supplemental Figure 2)—to assess clinicians’ management of suspected malaria patients. Supervisors use this checklist to
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 of service delivery.9–16 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.17 However, there remains a paucity of evidence on the direct impact of these inputs, or facility readiness more generally, on the quality of care provided to febrile patients presenting at health facilities. An analysis of pooled OTSS data from nine countries supported by MalariaCare demonstrated the positive association between the overall performance of health facilities and the competency of health workers.5 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>Country</th>
<th>Round</th>
<th>Timing</th>
<th>No. of facilities</th>
<th>No. of provider observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameroon</td>
<td>3</td>
<td>April–May 2021</td>
<td>200</td>
<td>215</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>September–October 2021</td>
<td>367</td>
<td>395</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>February–March 2022</td>
<td>285</td>
<td>285</td>
</tr>
<tr>
<td>Mali</td>
<td>3</td>
<td>October–November 2020</td>
<td>235</td>
<td>484</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>March–April 2021</td>
<td>234</td>
<td>406</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>November–December 2021</td>
<td>230</td>
<td>396</td>
</tr>
<tr>
<td>Niger</td>
<td>2</td>
<td>November–December 2020</td>
<td>93</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>April 2021</td>
<td>66</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>July–September 2021</td>
<td>82</td>
<td>96</td>
</tr>
</tbody>
</table>
was available. The availability of ACTs was dependent on personnel (all categories) having received classroom training in materials variable as a continuous variable. Facilities with the availability of ACT for all age groups across each country. (In Cameroon, a minimum 1-month supply was required.) In most instances, commodity and material availability of ACTs were considered not to be available. Availability of ACTs was de ned as a facility that scores ≥50% of health workers who received classroom training, availability of materials, availability of RDTs, and availability of ACTs. A competent health worker is de ned 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, classi cation, and correct treatment and referral based on RDT result. The case management competency score data were retained as a continuous variable. Facility readiness is de ned 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 de ned 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 de ned 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 de ned 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 rst 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 signi cant 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 fi ndings and relevant contextual information.

RESULTS

The fi nal 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...
availability, correct classification of malaria, requesting a malaria test, and providing correct treatment to patients remained high (reaching $80\%$) in each country across all rounds of OTSS visits analyzed.

Similarly, there were improvements between the first and last assessed rounds for each country for the percentage of health worker observations that met the 90% score for case management competency across the three countries: 10.4% in round 3 to 18.9% in round 5 for Cameroon, 37.9% in round 3 to 45.6% in round 5 for Mali, and 16.3% in round 2 to 42.7% in round 4 in Niger.

Statistical regression analysis. All countries demonstrated significant associations between overall health facility readiness and case management competency (Table 3). In Cameroon and Mali, all three rounds of OTSS indicated this positive association. In Niger, only round 3 of OTSS indicated a significant relationship between overall readiness and case management competency.

Table 2. Health facility readiness and health worker competency for Cameroon, Mali, and Niger across three rounds of OTSS

<table>
<thead>
<tr>
<th>Health facility readiness</th>
<th>Cameroon, n (%)</th>
<th>Mali, n (%)</th>
<th>Niger, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health facilities that have a 90% score for overall readiness</td>
<td>215 (7.9)</td>
<td>480 (33.1)</td>
<td>106 (5.7)</td>
</tr>
<tr>
<td>Health facilities that have ≥50% of trained health workers</td>
<td>215 (36.3)</td>
<td>384 (37.5)</td>
<td>79 (31.6)</td>
</tr>
<tr>
<td>Average score of health facilities that have the necessary materials</td>
<td>215 (79.3)</td>
<td>374 (41.7)</td>
<td>96 (29.2)</td>
</tr>
<tr>
<td>Health facilities that have RDTs available</td>
<td>215 (96.3)</td>
<td>408 (41.9)</td>
<td>106 (7.4)</td>
</tr>
<tr>
<td>Health facilities that have ACTs*</td>
<td>215 (77.7)</td>
<td>374 (38.5)</td>
<td>79 (32.9)</td>
</tr>
</tbody>
</table>

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

Health worker competency

| Health workers who have a 90% score for competency | 211 (10.4) | 475 (45.6) | 106 (8.1) |
| Health workers who classified malaria correctly | 211 (97.0) | 282 (93.6) | 109 (100.0) |
| Health workers who requested a malaria test† | 215 (97.2) | 478 (95.0) | 106 (97.9) |
| Health workers who provided the correct treatment‡ | 87 (83.9) | 76 (71.0) | 84 (88.8) |

†A malaria test was defined 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.
§Cameroon round 3 had data for pregnant women only; there were no data for nonpregnant women.

DISCUSSION

This study is one of the first to assess the association between facility readiness factors and competency in malaria case management and to characterize the improvements in health worker practice over time.
### Table 3

Association between provider competency and health facility readiness in Cameroon, Mali, and Niger over three rounds of OTSS

<table>
<thead>
<tr>
<th>Descriptive statistic</th>
<th>Cameroon</th>
<th>Mali</th>
<th>Niger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage change in case management competency score (y) with each 10% increase in overall readiness score (x)</td>
<td>3.7 (1.9–5.4)*</td>
<td>4.8 (3.7–5.9)*</td>
<td>3.0 (1.8–4.3)*</td>
</tr>
<tr>
<td>Percentage change in case management competency score (y) with each 10% increase in materials available (x)</td>
<td>2.1 (1.3–2.9)*</td>
<td>2.4 (1.8–3.0)*</td>
<td>5.4 (3.3–7.6)*</td>
</tr>
<tr>
<td>Percentage change in case management competency score (y) when facilities have ≥50% trained personnel (x)</td>
<td>2.4 (1.0 to 5.9)</td>
<td>0.6 (–1.6 to 2.7)</td>
<td>3.1 (1.0–5.3)</td>
</tr>
</tbody>
</table>

*Values in bold type are statistically significant.

Impact of readiness factors on health worker competencies and malaria burden settings. Our study’s findings build upon those from Malariacare and reinforce further the evidence supporting high importance of facility readiness for high-quality malaria case management at the individual level, specifically in high-prevalence areas. The analysis of the three rounds of OTSS visits in PMI Impact Malariacare facilities shows that greater facility readiness, represented by critical inputs such as classroom training, classroom attendance, and supplies, has a stronger influence on health worker performance than other rounds. This indicates that health workers who receive classroom training and supplies are more likely adhered to malariacare guidelines and competencies, although there is evidence greater competency in health worker performance could be achieved with higher facility readiness. Not surprisingly, health workers who are trained and provided with the necessary materials and commodities are more likely to deliver high-quality malaria case management services. This highlights the importance of facility readiness for high-quality malaria case management and reinforces evidence that greater readiness is associated with improved health worker performance and case management outcomes. 

Our analysis also assessed the impact of overall readiness and commodity availability on health worker performance. Not surprisingly, health workers' performance was more influenced by overall readiness and commodity availability in the third round of OTSS in Mali, which demonstrated high competency in all readiness and supplies were available. Meanwhile, in Cameroon and Niger, the fourth OTSS round between availability of RDTs and ACTs, and health workers' competency in health management was not established in all three rounds. Although this association was not significant in the third round in Mali, it demonstrates the unique role of classroom training in improving health worker performance and suggests that further evidence to existing literature that OTSS likely contributed to improvements in health worker performance.
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.

Published online December 26, 2023.

Received July 21, 2023. Accepted for publication October 2, 2023.

Note: Supplemental material appears at www.ajtmh.org.

Acknowledgments: We acknowledge Tabitha Kibuka and Jean-Yves Mukamba for their contribution to the initial conceptualization of this study, and Gretchen Newby for her review of the draft manuscript. Many thanks to the national malaria control programs and PMI Impact Malaria staff involved in the implementation of OTSS in Cameroon, Mali, and Niger.

Financial support: Funding for this study was provided by the U.S. President’s Malaria Initiative.

Disclosure: This study received ethical clearance from the Population Services International Research Ethics Board and Comité National d’Ethique de la Recherche pour la Santé Humaine (2023/07/28/L/CNERSH/SP) in Cameroon and the Comité National d’Ethique pour la Recherche en Santé in Niger (18/2023/CNERS). The Program National de Lutte contre le Paludisme in Mali exempted the study from ethical review. The contents of this article are the responsibility of the authors and do not necessarily reflect the views of the United States Agency for International Development or the U.S. government.

Authors’ addresses: Yves-Marie Bernard, Jehan Ahmed, Jadmien Mostel, Thierno Ba, Annie Corielan Ciceron, Moses Busiga, and Lawrence M. Barat, PMI Impact Malaria, Population Services International, Washington, DC, E-mails: ybernard@psi.org, jahmed@psi.org, jmostel.phc@gmail.com, tba@psi.org, aciceron@psi.org, mbusiga@gmail.com, and ibarat@psi.org. Aissata Koné, Programme National de Lutte contre le Paludisme du Mali, Bamako, Mali, E-mail: aissatakone700@gmail.com. Beh Kamate, Fatoumata Sidibé, and Chebou Diallo, PMI Impact Malaria, Population Services International, Bamako, Mali, E-mails: bkmate@psimali.org, fsidibe@psimali.org, and cdiallo@psimali.org. Alouzma Makayi, Programme National de Lutte contre le Paludisme du Niger, Niamey, Niger, E-mail: mayaki2000@yahoo.fr. Daniel Christian Koko and Arouna Djibrilla, PMI Impact Malaria, Population Services International, Niamey, Niger, E-mails: dkoko@psi.org and arouna@psi.org. Joel Ateba, Programme National de Lutte contre le Paludisme du Cameroun, Yaoundé, Cameroon, E-mail: atebadoc@gmail.com. Eric Tchinda Melli, PMI Impact Malaria, Jhpiego, Yaoundé, Cameroon, E-mail: erictchinda@jhpiego.org, Christophe Tchadjue, PMI Impact Malaria, Association Camerounaise pour le Marketing Social, Yaoundé, Cameroon, E-mail: ctchadjue@acms-cm.org. Kevin S. Griffith and Jordan Burns, U.S. President’s Malaria Initiative, USAID, Washington, DC, E-mails: jorburns@usaid.gov and kgriffith@usaid.gov.

This is an open-access article distributed under the terms of the Creative Commons Attribution (CC-BY) License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

REFERENCES


