PAPUA NEW GUINEA NATIONAL HEALTH FACILITY SURVEY 2021: AVAILABILITY AND QUALITY OF MALARIA CASE MANAGEMENT

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Executive Summary

The Global Fund to Fight AIDS, Tuberculosis and Malaria has supported the Government of Papua New Guinea (PNG) with most of the funding required for the implementation of the National Malaria Control Program. Universal and timely malaria case management is one of the main components of the National Malaria Strategic Plan 2021-25. In collaboration with the National Department of Health (NDoH), the Papua New Guinea Institute of Medical Research (PNGIMR) conducted five cross-sectional health facility surveys between 2010 and 2016 to assess the availability and quality of malaria treatment services countrywide. Another countrywide Health Facility Survey was conducted in 2021-2022 aiming to provide an update on the availability of infrastructure, equipment and consumables, and health worker training, knowledge and treatment practices relevant for implementing malaria case management at formal health facilities across PNG.

The HFS has been designed to answer the following questions broadly:

- What is the **availability of malaria case management services** in PNG? What proportion of facilities offers various aspects of malaria case management, and do these facilities have the required infrastructure, commodities, and support systems available?
- What is the **quality of malaria case management,** and to what extent does the malaria case management process follow national guidelines?
- What is the **knowledge and practice of health workers** regarding malaria case management? Do health workers receive training and supportive supervision?
- Are **clients and service providers satisfied** with the service delivery environment and quality?

Key outcome measures of the Health Facility Survey include:

- The proportion of health facilities with working microscopy or malaria rapid diagnostic tests (mRDT) in stock
- The proportion of health facilities with the first-line antimalarial artemether-lumefantrine (AL) in stock
- The proportion of health workers trained in the NMTP
- The proportion of febrile cases presenting to health facilities that received a parasitological test
- The proportion of confirmed malaria cases that received AL treatment
- The proportion of health facilities providing IPTp to pregnant women

A total of 76 health facilities were surveyed in all 22 provinces of PNG, including 44 health centres and 32 aid posts. All health facilities were randomly selected. In addition, nine provincial or district-level hospitals were also surveyed to explore referral facility-level malaria case management. A total of 141 clinicians from health centres and aid posts participated in health worker interviews and 545 febrile case management observations were done at the health facilities. Of these observations, 387 patients agreed to participate in an exit interview.

All 44 health centres and 88.6% (95% CI 73.5, 95.5) of aid posts had mRDTs in stock at the survey time. However, the percentage of health centres with working microscopy was low (14.3%, 95% CI 6.5, 28.3).

Overall, 79.6% (95% CI 66.6, 88.4) of health facilities had AL in stock (any weight/age package). Only 33.7% of health facilities had all weight/age-group doses of AL, including 49.3% of health centres and 24.1% of aid posts.

513 clinical staff were employed in the 76 health facilities at the time of the survey. Of these, only 25% were reported to have attended formal training in the current national malaria treatment protocol (NMTP) by health facilities' officers-in-charge. It was estimated that only one-fourth of nurses were trained in the current NMTP. During health worker interviews, 30% of participating health workers responded that they received training in the current NMTP. However, during the health facility checklists and provider interviews, the field teams neither referred to any specific training program nor a year. When explicitly asked for malaria-related training since 2020, only 5.5% of health workers said they had received training.

During 545 clinical observations, 456 febrile cases were offered a malaria diagnostic test. The proportion of febrile cases presenting to health facilities that received either mRDT or microscopy test was 81.1% (95% CI 74.1, 86.5). Of the tested patients, 37.7% (95% CI 30.1, 44.9) were found to be malaria-positive. During the health worker interviews, 90.8% (95% CI 77.9, 96.6) of the interviewed health workers reported to use mRDTs for diagnosing malaria.

The proportion of confirmed malaria cases receiving first-line antimalarial treatment was 70.4% (95% CI 57.3, 80.9). Nearly 30% of first-line antimalarial prescriptions did not comply with the national guidelines in terms of dosage. This finding supports the importance of conducting further training on the NMTP. Overall, 88.3% (95% CI 83.7, 91.7) of clinical observations complied with the national guidelines in that test-negative cases were not treated with an antimalarial and test-positive case received the correct dose of AL.

Of 76 health facilities, 58 facilities were offering antenatal care (ANC) at the time of the survey. The proportion of ANC-providing facilities reported offering intermittent preventive treatment for malaria to pregnant women was 97% (95% CI 88.7, 99.2). Irrespective of the ANC-providing status, 82.2% (95% CI 72.6, 88.9) of all surveyed health facilities reported having SP in stock. In health worker interviews, 93% of clinicians who reported administering IPTp displayed good knowledge of SP prescription practices at survey time.

Overall, the 2021 Health Facility Survey found shortfalls in the availability of malaria diagnostics and first-line treatment in health facilities and incorrect antimalarial dosage practices. Improvements in the supply chain management and regular (formal) training of health workers in the current NMTP, alongside supportive supervision activities through regional malaria coordinators, seems highly warranted.

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Abbreviations

AP	Aid Post
ANC	Antenatal Care
AI	Artemether or Artesunate Injection
AL	Artemether-Lumefantrine
ACT	Artemisinin-based Combination Therapy
CHW	Community Health Worker
CI	Confidence Interval
DP	Dihydroartemisinin-Piperaquine
DX	Doxycycline
HHFA	Harmonized Health Facility Assessment
HC	Health Centre
HEO	Health Extension Officer
HFS	Health Facility Survey
IPTp	Intermittent Preventive Treatment in Pregnancy
LLIN	Long-Lasting Insecticidal Nets
mRDT	Malaria Rapid Diagnostic Test
NDoH	National Department of Health
NMCP	National Malaria Control Program
NMSP	National Malaria Strategic Plan
NMTG	National Malaria Treatment Guidelines
NMTP	National Malaria Treatment Protocol
NO	Nursing Officer
ODK	Open Data Kit
PNG	Papua New Guinea
PNGIMR	Papua New Guinea Institute of Medical Research
P.f.	*Plasmodium falciparum*
P.v.	*Plasmodium vivax*
PQ	Primaquine
QI	Quinine Injection
QT	Quinine Tablet
SC	Sub-Health Centre
SD	Standard Deviation
SP	Sulphadoxine/Pyrimethamine
UC	Urban Clinics
VHV	Village Health Volunteer
WHO	World Health Organization

1 Introduction

The Global Fund to Fight AIDS, Tuberculosis and Malaria has supported the government of Papua New Guinea (PNG) with most of the funding required for the implementation of the National Malaria Control Program (NMCP). The NMCP has been implementing national distribution campaigns of long-lasting insecticidal nets (LLIN) since 2004, followed by the roll-out of malaria rapid diagnostic tests (mRDT) and artemisinin-based combination therapy (ACT) in health facilities in late 2011. The Papua New Guinea Institute of Medical Research (PNGIMR) provides a range of independent evaluation activities supporting the NMCP, including cross-sectional countrywide health facility surveys (HFS).

Universal and timely malaria case management is one of the main components of the National Malaria Strategic Plan (NMSP) 2021-25, consisting of the early parasitological diagnosis and prompt appropriate treatment for all confirmed cases of malaria according to the latest National Malaria Treatment Guidelines (NMTG) [1]. According to PNG NMSP, the two key components of malaria case management are a) ensuring early and accurate diagnosis and b) ensuring effective rational treatment nationwide, according to the NMTGs. The HFS has been designed to assess these two activities' performance by evaluating the availability of diagnostic tools, medicines and human resources and the quality of malaria cases.

Consistent with the recommendations of the World Health Organization (WHO), the current NMTG stipulates that all fever or suspected malaria cases be tested for malaria infection by microscopy or rapid diagnostic test (mRDT). Test-positive cases are to be treated with artemether-lumefantrine (AL) as first-line treatment for uncomplicated *Plasmodium falciparum (P.f.)* malaria, AL plus primaquine (PQ) as first-line treatment for uncomplicated *Plasmodium vivax (P.v.)* malaria and artesunate injection followed by an entire oral course of AL for first-line treatment of severe *P.f.* malaria, with the addition of oral PQ for the treatment of severe *P.v.* malaria [2]. Dihydroartemisinin-piperaquine is the second-line treatment for uncomplicated *P.f.* and *P.v.* malaria, with the addition of PQ for the latter.

In collaboration with the National Department of Health (NDoH), PNGIMR assessed the availability and quality of malaria treatment services in countrywide cross-sectional HFS conducted in 2010, 2011, 2012, 2014 and 2016; after that, no funding for such surveys was made available. The previous surveys found that the availability of mRDTs and artemisinin-based combination therapy (ACT) increased steeply after their official introduction in the public health care system and peaked in 2014 with a subsequent decline [3]. The number of health workers trained in the new treatment protocol (including mRDT testing and ACT treatment) peaked in 2011, the year most of the training took place and has decreased substantially since that time. However, significant changes in health worker practice took place after 2011, with an increase in the use of mRDT, increased administration of the new first-line antimalarial AL and reduced antimalarial prescription to malaria test-negative patients. While these previous surveys suggest that health worker compliance with treatment guidelines improved, treatment counselling practice was often poor. Approximately 35-40% of aid posts were out of operation at any time [3].

As part of the Global Fund to Fight AIDS, Tuberculosis and Malaria funding support 2021-2023 to the NMCP, another countrywide HFS was scheduled for 2021. The main objective of the HFS 2021 was to provide an update on the availability of infrastructure, equipment, and

consumables and health worker training, knowledge and treatment practices relevant to implementing malaria case management at formal health facilities across PNG.

The HFS 2021 was extended to collect contextual information on health service readiness that is not directly related to malaria case management. The HFS implementation and analysis procedures were designed to be consistent with previous HFS rounds. In addition, the HFS 2021 also included provincial and district hospitals for an exploratory assessment of malaria case management in referral facilities.

The HFS 2021 also included selected indicators of the harmonized health facility assessment tool of WHO (HHFA) to allow comparison of indicators of health facility services and capabilities across countries. The HHFA is a comprehensive health facility survey that assesses the availability of health facility services and the capacities of facilities to provide services at the required standards of quality [4]. The primary focus of the selected HHFA indicators is on malaria-related service availability, service readiness, quality of care and management.

2 Methodology

This chapter presents the study design, information on study sites, sampling strategy, description of instruments, participant recruitment, survey implementation, data management and approach to analyses.

2.1 Study design

The HFS is a countrywide cross-sectional survey of randomly selected formal health facilities in 22 provinces of PNG. The HFS complements information collected through the routine National Health Information System (NHIS) and provides greater detail on malaria case management. The HFS has been designed to answer the following questions broadly:

- What is the **availability of malaria case management services** in PNG? What proportion of facilities offers various aspects of malaria case management, and do these facilities have the required infrastructure, commodities, and support systems available?
- What is the **quality of malaria case management,** and in particular, to what extent does the malaria case management process follow national guidelines?
- What is the **knowledge and practice of health workers** regarding malaria case management? Do health workers receive training and supportive supervision?
- Are **clients and service providers satisfied** with the service delivery environment and quality?

The HFS 2021 design was consistent with that of previous HFS rounds. In addition, this survey was designed to provide data for calculating several HHFA malaria service availability and readiness indicators.

2.2 Study sites and sampling

Despite the COVID-19 pandemic crisis, the HFS 2021 was carried out in all 22 provinces of PNG. The HFS covered all levels of health facilities, including both government-operated and faith-based, but not private doctors' clinics, which generally only serve a minority urban population. In PNG, health services are provided by hospitals, health centres and sub-health centres (HCs), as well as aid posts (AP) which are successively upgraded to community health posts.

HCs/SCs were selected by province from a list of all operating HCs/SCs provided by the NDoH, using a simple random sampling procedure. The survey sample consisted of two HCs/SCs in each province and up to two APs/community health posts under the supervision of each selected HC/SC. The sample size of 44 HCs/SCs was estimated to allow measuring an expected proportion of 90% for each indicator (e.g., the proportion of suspected malaria cases that receive a parasitological test at public sector health facilities) with a 95% level of confidence and a precision of 0.09 based on the following formula:

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}$$

where n' = Sample size with finite population correction,
N = Population size,
Z = Z statistic for a level of confidence,
P = Expected proportion (If the prevalence is 20%, $P = 0.2$), and
d = Precision (If the precision is 5%, then $d = 0.05$)

The sampling frame included all HCs/SCs reported operational in 2021, including government and faith-based health facilities, based on a list maintained by the NDoH. If an HC/SC oversaw more than two operational APs at the time of the HFS, two of them were randomly selected by the field investigators on site. The sampling frame for AP/community health posts included all operational AP/community health posts under the supervision of the HC/SC at the time of the survey. In the HFS 2021, we included nine hospitals for an exploratory assessment of malaria case management in referral facilities. The hospitals were selected based on convenience in urban centres through which the HFS field teams transited to the randomly sampled HCs/SCs.

2.3 Survey Instruments

Data collection forms follow the structure of the Service Provision Assessment Surveys. Four survey instruments were used to collect data, including structured questionnaires and checklists. Each instrument was administered to different study participants at the study health facilities. They included: 1) health facility checklist, 2) health worker interview, 3) febrile case management observation, and 4) exit interview with patient or caregiver. All these instruments were programmed for the electronic data collection on tablet computers using Open Data Kit (ODK) software. All the survey instruments were pilot tested prior to the beginning of the survey.

2.3.1 Health facility checklist

A structured checklist was completed with the officer in charge of health facilities by the field teams. This instrument was designed to assess the availability of essential medical supplies and equipment, human resource capacity and infrastructure, and general provision of malaria case management services at the facility level. Key questions included the number of clinical staff employed and trained in the National Malaria Treatment Protocol (NMTP), malaria diagnostics, and antimalarial treatment availability. The PNGIMR field team leader verified the availability of diagnostics and medicines. This checklist also collected information on the number of functional APs operating under the supervision of the HC/SC, which enabled the survey teams to randomly select two APs for the survey.

2.3.2 Health worker interview

An interviewer-administered questionnaire was completed with all available and consenting health workers employed at participating health facilities by the field teams. The questionnaire contained open and closed questions about education, work experience and supervision, type and utility of work-related training received, knowledge, attitudes and practices relevant to febrile case management and intermittent preventive treatment of malaria in pregnancy (IPTp), experiences implementing malaria/febrile case management and IPTp guidelines.

2.3.3 Febrile case management observation

Features of the clinical case management of patients presenting with fever or a recent history of fever were recorded in a structured checklist completed by a trained field team member who silently observed the management of fever patients from the point of initial contact with a health worker until service exit or admission onto a treatment ward. During the observation, a field team member recorded whether specified actions did or did not occur and the content of specific actions (e.g., whether an mRDT was conducted for a patient with fever and, if yes, what the test result was). The checklist was designed to assess the features of clinical case management and was divided into discrete sections about consultation and diagnosis, prescription, and treatment counselling.

2.3.4 Exit interview with patient or caregiver

An interviewer-administered questionnaire was done with fever patients or their caregivers (in the case of minor patients) at the time-of-service discharge. This questionnaire included a range of open and closed questions about the patient's treatment experience, their retention of clinical recommendations (such as diagnosis and treatment counselling advice), treatment accessibility and cost, and treatment-seeking behaviour.

2.4 Survey implementation procedures

The HFS was conducted between August 2021 and May 2022 by nine PNGIMR field investigators in three teams working simultaneously in different provinces. During the survey period, PNG had faced a surge in COVID-19 cases resulting in local travel restrictions and closure of some health facilities, requiring multiple re-scheduling. Despite the pandemic and several incidents of civil unrest, the field teams completed the HFS within less than seven months in all 22 provinces. Each field team consisted of one graduate scientific officer and two research assistants. Before the survey, all team members received extensive training consisting of lectures on the project background, survey methodology, and intensive instruction and practice on the survey protocol and instruments.

Prior to any health facility visit, the respective provincial health authorities were informed and requested to commission a health officer to accompany the field team. Upon arriving at each health facility, the field team conducted a '*tok save*' (information session) with the officer in charge and, following this, with the health facility staff. Once permission to proceed had been obtained, the field team leader established an agreeable process for survey completion in consultation with the officer in charge. Members of each field team spent between three to five days at each participating HC/SC and up to one day at each participating AP.

Four survey instruments were completed at each health facility whenever possible and appropriate. The health facility checklist was completed once at each facility, while the remaining three instruments were completed as many times as possible. The clinician and exit interview questionnaires were available in English and Tok Pisin. Completed survey instruments were uploaded to the ODK central server and reviewed by a senior scientist during data collection as a quality control measure. Supervisory field visits were conducted with each team to ensure the quality of data collected.

2.5 Recruitment of study participants

The Health Facility Checklist was completed with the officer-in-charge of the health facility or a suitably qualified respondent available at the time of the survey. Additional health workers may have been consulted if relevant, for example, a storekeeper to obtain information on the stock of commodities.

Health Worker Interviews were conducted with all health workers of surveyed HCs/SCs, APs or community health posts. In hospitals, the interviews were conducted with a selection of health workers representing each cadre (i.e., doctor, health extension officer, nursing officer, community health worker) involved in treating febrile illnesses at the outpatient and inpatient departments.

The Febrile Case Management Observation included patients of all ages with a febrile illness presenting as outpatients to the surveyed health facilities or hospitals. Patients admitted to an inpatient ward were only observed until admission.

Exit Interviews were conducted with patients or caregivers of patients (under 18 years old) being treated for a febrile illness at the surveyed health facilities.

The requirement for inclusion in interviews or observations was written informed consent from the interviewee, the observed patient, or their adult caregiver. Health worker interviews were limited to those health workers present at the facility during the survey days.

2.6 Data management and analysis

All the instruments were programmed with ODK software, and the data was collected electronically. The field teams used the ODK Collect android app on tablet computers for data collection. As soon as the teams could access the internet, the team leaders checked and finalized the forms and uploaded all the finalized forms to the ODK Central server hosted at Swiss TPH. A senior scientist checked the quality of the data collected in the ODK server and accepted the submissions. Throughout the HFS, a dashboard was maintained at GitHub to monitor the progress of the data collection. Upon completing the survey, the datasets from each questionnaire were downloaded as a spreadsheet for data cleaning and analysis. Stata/SE 16.1 (Stata Corp LLC, TX, USA) was used for data analyses.

Descriptive analyses of the four datasets were conducted. In order to calculate representative national estimates from the province-stratified sample, survey weights were applied at the level of the health facility. The exact weights were applied to the repeated observations within a sampled facility. Survey weights were calculated as the inverse of the probability of an HC/SC being selected within a province. For APs, these weights are multiplied by the inverse probability of an AP being selected among all APs under the supervision of a given HC/SC.

Analyses of all survey instruments allowed for the complex survey design using the "*svy"* command set in Stata. The descriptive analyses were stratified by the type of health facility

(HC/SC and AP) to compare with the results of previous HFS rounds[1]. The health facilities were set as sampling units. Weighted proportions and logit-transformed 95% confidence intervals (CIs) were estimated for all key indicators. Data from hospitals were analysed and presented separately in this report; the convenience sample does not necessarily include a representative sample of hospitals.

2.7 Ethical considerations

Written informed consent was sought from the officer in charge at all participating health facilities and all participating clinicians, patients, or their adult caregivers prior to the interview or clinical observation. A health facility would have been excluded from participation if voluntary consent by the officer in charge had not been obtained (nil occurrence). No compensation was offered for participation in the survey. Ethical clearance was provided by the Medical Research Advisory Committee (MRAC) of PNG in June 2021 (MRAC No. 21.05) following approval by the Institutional Review Board of the PNGIMR (IMR IRB No. 2108). External quality assurance commissioned by the Global Fund had provided support throughout the survey planning, implementation, and analysis.

[1] HFS 2010, 2011, 2012, 2014 and 2016 results were not weighted.

3 Results

This chapter reports the principal findings of the HFS. The results are presented separately for the four survey instruments and stratified by a health facility, distinguishing 'health centre' (which also includes sub-health centres and urban clinics) and 'aid post' (which also includes community health posts). We used the term 'health facilities' in this report when referring to HCs and APs. Key results from the surveyed hospitals are reported separately from the HCs and APs. In the HFS 2021, a total of 44 HCs, 32 APs and nine hospitals were surveyed across 22 provinces of PNG.

3.1 Health facility checklist

This section presents the results of the availability of health facility infrastructure, equipment, diagnostics, and medicines relevant for managing malaria cases, intermittent preventive treatment services, village health volunteer programmes, and the operational status of APs. The results from this section are used to develop selected WHO HHFA malaria service availability and readiness indicators.

3.1.1 Sample characteristics

A total of 76 health facilities were surveyed in all 22 provinces of PNG, including HCs and APs. As shown in Table 1, 44 HCs were randomly selected, and 32 APs under these HCs were surveyed across the four regions of PNG. In addition, nine provincial or district-level hospitals were also surveyed. Out of 76 health facilities, 58% were government-operated, 32% faith-based, and either non-governmental organizations or private companies operated the remaining health facilities. Out of nine hospitals, seven were operated by the government, one was a faith-based and one a private hospital. These 76 surveyed health facilities covered 1430 villages (i.e., approximately 6% of the total number of villages in PNG, Census 2011).

Table 1 Number of surveyed health facilities by health facility type, and region

Health Facility	Region				Total
	Highlands	Islands	Momase	Southern	
Health Centres	14	9	8	13	44 (52%)
Aid Posts	6	9	10	7	32 (38%)
Hospital	1	4	1	3	9 (10%)
Total	21 (24.7)	22 (25.9)	19 (22.3)	23 (27.1)	85 (100.0)

3.1.2 Availability of mRDTs or working microscopy

All 44 HCs had unexpired mRDTs in stock, and 88.6% of APs had mRDTs in stock at the survey time. However, the percentage of working microscopes with essential consumables was low in HCs. As expected, due to official requirements, no AP had functioning microscopy facilities. Table 2 shows the availability of mRDTs or working microscopes by health facility type.

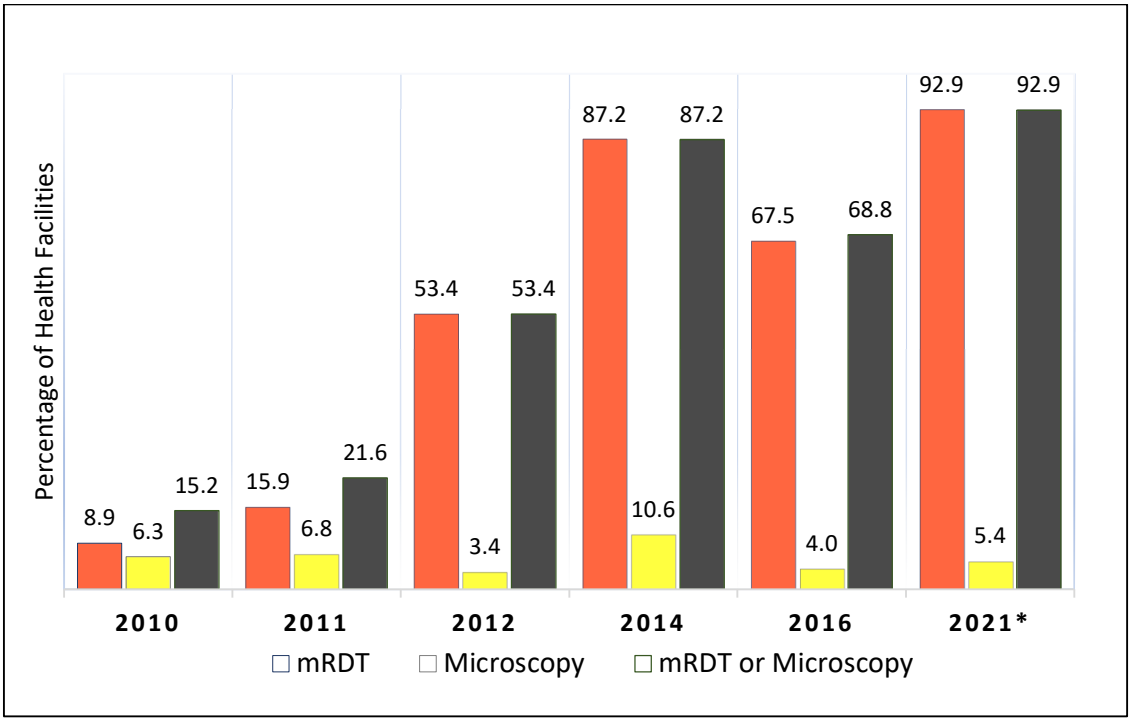
All nine hospitals had malaria mRDTs in stock; however, only seven had an operating microscope with essential consumables and personnel at the time of the survey.

Table 2 Percentage of health facilities with unexpired mRDT in stock, working microscopy available and either unexpired mRDT/working microscopy

Diagnostic Test	Type		Overall % (95% CI)
	Health Centres % (95% CI)	Aid Posts % (95% CI)	
mRDT	100 (-)	88.6 (73.5, 95.5)	92.9 (83.2, 97.2)
Microscopy [a]	14.3 (6.5, 28.3)	0 (-)	5.4 (2.4, 11.9)
mRDT or microscopy	100 (-)	88.6 (73.5, 95.5)	92.9 (83.2, 97.2)

a. Working microscopy is defined as the presence of a functional microscope, all essential supplies, including Giemsa stain, slides and (in the case of electric microscopes) power and a trained RLA or MLA in employment. It was not expected in aid post settings (i.e., '0' was the expected result).

Figure 1 Trend in proportion of health facilities with working microscopy or with mRDT in stock



* Weighted proportions

Figure 1 compares the proportions of health facilities with working microscopy or mRDT in stock across all the HFS surveys. The proportion of health facilities with mRDT stock had substantially improved in the HFS 2021, particularly compared to the last survey conducted in 2016. However, there was not much difference in the proportions of health facilities with working microscopy across all surveys.

3.1.3 Availability of first-line and second-line antimalarial treatment regimens

Table 3 shows the percentage of health facilities stocking artemether-lumefantrine (AL) in four available weight packages on the day of the survey. AL is the current first-line treatment for uncomplicated malaria (in combination with primaquine, in case of an infection with *P.v. or*

P. ovale) at a dosage of 2 mg/kg/dose (artemether) & 12 mg/kg/dose (lumefantrine) in 6 doses over 3 days given at 0h, 8h, 24h, 36h, 48h & 60h, best given with a fatty meal to improve absorption. The PNG National Malaria Treatment Policy defines four weight groups, corresponding to 1, 2, 3, and 4 tables of 20 mg artemether + 12 mg lumefantrine per dose [5].

Approximately half of the APs had AL available for each weight category. The availability of AL in HCs ranged from 66% for the 5-15 kg category to 82% for the 25-35 kg category. At least one blister pack of AL (any weight group) was available in 93% of HCs and 72% of APs. However, less than 50% of HCs and less than one quarter of APs had all doses of AL available.

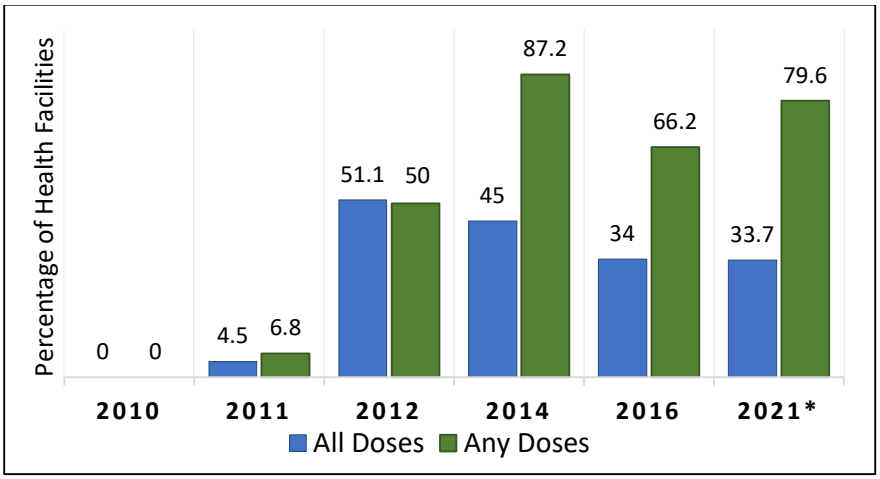
Table 3 Percentage of health facilities with artemether-lumefantrine (AL) in stock

AL dose	Type		Overall % (95% CI)
	Health Centres % (95% CI)	Aid Posts % (95% CI)	
Infant (5-14.9kg)	65.7 (50.2, 78.4)	42.0 (25.8, 60.2)	51.1 (39.3, 62.7)
Child (15-24.9kg)	78.5 (66.1, 87.2)	56.1 (37.1, 73.4)	64.7 (51.6, 75.9)
Youth (25-34.9kg)	82.4 (68.9, 90.8)	48.5 (30.9, 66.4)	61.4 (48.6, 72.9)
Adult (≥35kg)	81.2 (69.3, 89.2)	53.2 (33.8, 71.7)	63.9 (50.4, 75.5)
All doses[b]	49.3 (36.8, 61.9)	24.1 (12.0, 42.5)	33.7 (23.4, 45.9)
Any doses[c]	92.6 (81.8, 97.2)	71.5 (51.6, 85.5)	79.6 (66.6, 88.4)

a. The quantity of each medication was not accounted for in this analysis; rather, the data represent the percentage of health facilities that had at least one blister pack of the respective antimalarial in stock;
b. At least one blister pack in all weight categories was present at the health facility;
c. At least one blister pack from any weight category was present at the health facility.

Figure 2 compares the proportions of health facilities with AL in stock for all doses or any doses across the HFS rounds.

Figure 2 Trend in proportion of health facilities with artemether-lumefantrine (AL) in stock for all weight group packages (all doses) or any of the four-weight group packages (any doses)



* Weighted proportions.

In nine surveyed hospitals, AL doses were available for infants in five hospitals and children in eight hospitals. Seven hospitals had AL doses for the youth and adult weight categories in stock. Only in three hospitals AL doses for all weight categories were available. However, all nine hospitals had at least one blister pack of AL from any age category.

It should be noted that larger blister packs may be divided, and smaller blister packs combined to obtain the correct dosage for a particular patient. However, specific weight packages with the correct dosage were designed to facilitate provider compliance and patient adherence and the unavailability of certain weight packages may result in incorrect dosages being administered to a patient.

3.1.4 Availability of other antimalarial medications

Table 4 presents the percentages of health facilities with different antimalarial regimens specified in the current NMTP. The first-line treatment for uncomplicated *P.f.* malaria, AL, was most widely available in all health facilities (details provided in previous chapter). The combination of AL and primaquine (PQ) for the treatment of uncomplicated *P.v.* malaria was available in a majority of HCs but only in about half of all APs. Dihydroartemisinin-piperaquine (DP), the second-line treatment for uncomplicated malaria, was reported to be in stock in only 10.3% of health facilities, which was notably low compared to the other antimalarial drugs.

The first-line treatment regimens for severe *P.f.* (injectable artesunate plus AL), and for severe *P.v.* cases (injectable artesunate plus AL plus PQ), were available in >70% of HCs but only in a minority of APs. The second-line treatment for severe malaria, injectable quinine plus quinine tablets plus DX, was available only in a minority of health facilities.

Table 4 Percentage of health facilities with NMTP specified antimalarial medications

Medication [a]	Type		Overall
	Health Centres % (95% CI)	Aid Posts % (95% CI)	% (95% CI)
AL[b,c]	92.6 (81.8, 97.2)	71.5 (51.6, 85.5)	79.6 (66.6, 88.4)
AL + PQ [d]	85 (71.1, 92.9)	53.7 (34.1, 72.2)	65.7 (51.9, 77.2)
DP [e]	11.4 (4.6, 25.5)	9.6 (3.3, 25.1)	10.3 (4.9, 20.2)
AI + AL [f]	72 (57.8, 82.9)	45.4 (27.8, 64.3)	55.6 (43.4, 67.2)
AI + AL + PQ [g]	70.2 (56, 81.3)	34.9 (19.7, 54)	48.4 (37.1, 59.9)
QI + QT + DX [h]	38.6 (26, 52.9)	16.7 (6.5, 36.7)	25.1 (15.8, 37.5)

a. The quantity of each medication was not accounted for in this analysis; rather, the data represent the percentage of health facilities that had at least one vial or container (inclusive of a single, opened container) of the respective antimalarial in stock; b. Measured as the presence of blister packs in all four weight categories; c. First-line treatment for uncomplicated *P. falciparum* malaria; d. First-line treatment for uncomplicated *P. vivax* infection. e. Second-line treatment for uncomplicated malaria. f. First-line treatment for severe *P. falciparum* infection; g. First-line treatment for severe *P. vivax* infection; h. Second-line treatment for severe malaria infection. AL=artemether-lumefantrine, PQ=primaquine, DP=dihydroartemisinin-piperaquine, AI=artemether or artesunate injection, QI=quinine injection, QT= quinine tablets, DX= doxycycline.

Table 5 lists the percentage of health facilities with other specified antimalarials in stock at the survey time. Over half of the health facilities (58.3%) reported having artemether injections, and 40.2% of health facilities had artesunate injections in stock. Sulphadoxine/pyrimethamine

(SP), used for intermittent preventive treatment in pregnancy (IPTp), was present in 82.2% of the health facilities. Primaquine, specifically used to treat *P. vivax* infections, was available in 76.4% of the health facilities.

Table 5 Percentage of health facilities with other antimalarial medications in stock

Medication	% (95%CI)	Medication	% (95%CI)
Amodiaquine*	8.9 (3.4, 21.2)	Chloroquine*	10.6 (4.4, 23.3)
Artemisinin-naphthoquine*	11.1 (4.9, 23.4)	Dihydroartemisinin-piperaquine	10.3 (4.9, 20.2)
Artemether injections	58.3 (46.2, 69.4)	Doxycycline	47.9 (37.1, 58.8)
Artesunate tablets	19.2 (10.1, 33.5)	Sulphadoxine/Pyrimethamine	82.2 (72.6, 88.9)
Artemether tablets**	34.5 (22.5, 48.9)	Atovaquone-proguanil	2.9 (0.9, 8.8)
Artemether dispersible tablets**	5.3 (2.3, 11.8)	Primaquine	76.4 (62.9, 86)
Artesunate injections	40.2 (29.6, 51.8)	Quinine injections	19.7 (11.6, 31.6)
Artesunate suppositories	27.9 (18.8, 39.5)	Quinine tablets	30.4 (20.8, 41.9)

*The PNG National Malaria Treatment Policy makes no provision for the use of these antimalarials. **According to a 2007 World Health Assembly resolution (WHA60.18), oral artemisinin monotherapy (incl. e.g., artemether tablets) needed to be withdrawn from all pharmacies and health facilities around the world. Only rectal formulations for pre-referral treatment and injectable formulations for the management of severe malaria should be deployed.

All nine hospitals reported having AL, AL+PQ, AI+AL and AI+AL+PQ. All nine hospitals reported having PQ and SP in stock. Only three hospitals had DP, and five had QI+QT+DX in stock at the survey time. Only seven hospitals reported artemether and artesunate injections in stock at the survey time.

3.1.5 Intermittent preventive treatment for malaria in pregnancy

Table 6 presents the percentage of health facilities offering antenatal care (ANC) and IPTp services. All HCs reported providing ANC and IPTp services to pregnant women. However, more than half of the surveyed APs (18 of 32) reported not offering ANC services. Out of the APs offering ANC, 93.6% of APs offer IPTp services.

Table 6 Percentage of health facilities providing ANC services and intermittent preventive treatment (IPTp) for malaria during pregnancy

Providing Services	Type		Overall % (95% CI)
	Health Centres % (95% CI)	Aid Posts % (95% CI)	
Antenatal care	100 (-)	53.9 (33.2, 73.4)	71.5 (56.3, 83.1)
IPTp [a]	100 (-)	93.6 (76.7, 98.5)	97.0 (88.7, 99.2)

a. Denominator: health facilities offering ANC services

All nine hospitals reported offering ANC and IPTp services at the survey time.

3.1.6 Availability of malaria job aids and other resources

Tables 7 and 8 present the percentages of health facilities with specified malaria-related job aids, medical equipment, and other resources available at the time of survey. The field investigators observed these resources at the health facilities and used checklists to report. As shown in Table 8, less than half of the surveyed health facilities had a printed NMTP available to consult during malaria case management.

Malaria RDT user guide wall charts were observed in 70% of the health facilities. Health promotion flip charts like 'Saving lives by preventing malaria in PNG' were only present in less than half of the health facilities. Posters about malaria prevention, diagnosis and treatment were observed in only about 50% of the health facilities, and several were not in good condition. Over 86% of the health facilities maintained NHIS medical records but were not necessarily malaria-specific. Overall, field teams observed better resources in HCs than in APs.

As reported in Table 8, several essential medical equipment and resources like thermometers, stethoscopes, body weights, and treatment manuals for children and adults were observed in most of the surveyed health facilities. However, haemoglobin measuring equipment was not present in 85% of the health facilities at the time of survey. A similar observation was reported for infant blood pressure equipment.

Table 7 Percentage of health facilities with specified NMTP 'job aids'

Resource	Type		Overall % (95%CI)
	Health Centres % (95%CI)	Aid Posts % (95%CI)	
Printed National Malaria Treatment Protocol	65.6 (52, 77)	35.4 (22.5, 50.8)	46.9 (36.9, 57.2)
Wall chart - mRDT User Guide	91.4 (78.2, 96.9)	56.8 (37.5, 74.3)	70 (55.5, 81.4)
Wall chart - PNG Malaria Treatment Protocol	74.4 (63.1, 83.2)	45 (30.4, 64.3)	57.5 (45.6, 68.6)
Flip chart - Saving Lives by Preventing Malaria in PNG	51 (38.2, 63.7)	36.6 (21.4, 54.9)	42.1 (31.2, 53.8)
Poster - Talking about Malaria Treatment/*Toktok bilong marisin*	67.8 (54.2, 79)	42.3 (26.3, 60.1)	52 (40.8, 63.1)
Poster - Talking about Mosquito Nets/*Toktok bilong taunam*	62.2 (49.1, 73.7)	42.8 (25.6, 61.9)	50.1 (38.4, 61.9)
Poster - Talking about Malaria Testing/*Toktok long we long luksave*	64.4 (51, 75.9)	29.7 (16.7, 47.1)	42.9 (31.8, 54.8)
Clinical reporting - Malaria Register	100	81.1 (60, 92.5)	88.4 (73.8, 95.3)
Clinical reporting - Outpatient Tally Sheet	98.1 (88, 99.7)	90 (70.7, 97.1)	93.1 (80.6, 97.8)
Clinical reporting - NHIS monthly report (not malaria specific)	98.2 (88.7, 99.7)	79.5 (61.5, 90.4)	86.6 (74.4, 93.6)

Table 8 Percentage of health facilities with specified medical equipment and resources in stock

Resource	% (95%CI)
Working thermometer	81.7 (70.5, 89.2)
Working body weight scale (Infant)	66.3 (54.27, 76.6)
Working body weight scale (Adult)	71.2 (58.2, 81.5)
Working blood pressure machine (Infant)	21.3 (13.8, 31.4)
Working blood pressure machine (Adult)	66.2 (53.2, 77.2)
Working device to measure haemoglobin	15.2 (9.1, 24.5)
Stethoscope	91.6 (82.4, 96.3)
Disposable latex gloves	94.1 (81, 98.3)
Sharps container (plastic or cardboard)	90.8 (78.9, 96.3)
Disinfectant (alcohol, chlorine) for surfaces	76.3 (61.6, 86.6)
IMCI 10-step checklist (wall chart)	46.6 (36, 57.4)
Bluebook (standard treatment manual - Child)	80.1 (68.4, 88.2)
Green book (standard treatment manual - Adult)	77.4 (63.9, 86.9)

Among the nine surveyed hospitals, all hospitals had mRDT user guide wall chart, eight hospitals have printed NMTP, other job aids and treatment manuals. The field team observed that in only one hospital, there was no printed NMTP and haemoglobin machine, and in two hospitals no health promotional flip charts about savings lives by preventing malaria. All nine hospitals were maintaining malaria registry and NHIS monthly reports.

3.1.7 Health workers' reported training in NMTP

Overall, 513 clinical staff were employed at the survey time in 76 health facilities. Of these clinical staff, only 25% were reported to have been formally trained in the current national malaria treatment protocol (NMTP). One-fourth of nurses were trained in the current NMTP. Table 9 provides detailed information about malaria-related training by health workers' designation.

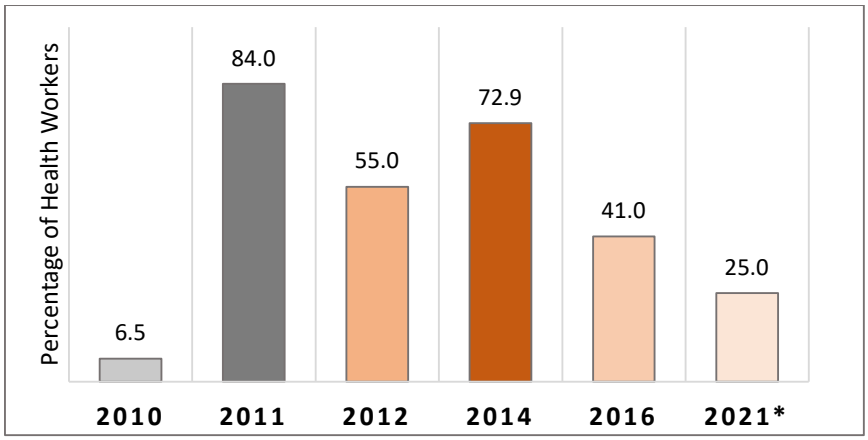
Table 9 Number and percentage of clinical staff employed and trained in current NMTP at the surveyed health facilities

Designation	Employed	Trained in current NMTP
	n	n (%)
MD	8	2 (25)
HEO	26	5 (19.2)
Nurse	188	48 (25.5)
CHW	280	69 (24.6)
RLA/MLA	11	4 (36.4)
Total	513	128 (25.0)

NMTP=National Malaria Treatment Protocol; MD=Medical Doctor; HEO=Health Extension Officer; CHW=Community Health Worker; RLA/MLA=Rural/Medical Laboratory Assistant.

Figure 3 compares the proportions of health workers with formal training in the current malaria treatment protocol across HFS rounds.

Figure 3 Proportion of healthcare providers with formal training in the current NMTP



* Weighted proportions

In nine hospitals, 1449 clinical staff were employed at the survey time; only 43% reported training in the current NMTP. Interestingly, out of 133 medical doctors, only 22 (15%) reported being trained in the current NMTP. Less than 50% of other health workers, including HEOs, nurses and CHWs, had been formally trained in the NMTP.

It should be noted that this question assessed the formal training in the NMTP and may not capture on-the-job training and training during supportive supervision activities.

3.1.8 Aid post supervision

Rural areas of PNG have community-based APs or health posts (collectively referred to here as 'AP'). Designated HCs supervise these APs. Hospitals do not supervise such APs. Table 10 presents the number of HCs with one or more APs under their supervision at the time of survey of 44 surveyed HCs. In addition, it also included the total number of supervised APs and the operational status of 34 HCs. The mean number of APs under supervision was 3.9 per HC at the time of survey. Despite the COVID-19 pandemic crisis, over 60% of APs were reported to be open and operational.

Table 10 Operational status of aid posts (AP) under the supervision of surveyed health centres

Aid Posts	**n (%)**
No. of health facilities supervising >= 1 aid posts	34 (77.3)
Total No. of APs under supervision	133
No. open (%)	80 (60.2)
No. closed for less than one month (%)	12 (9.0)
No. closed for greater than one month (%)	41 (30.8)

3.1.9 Health facilities supporting village health volunteers (VHV) programs

Of 44 surveyed HCs, 40 responded to the question, "*Does this health facility support a VHV or CMV or Marasin Meri/Man program?*". Only 40.4% (95%CI 27.5, 54.9) were supporting some form of VHV program (Table 11). Most of these HC reported offering training or supervision for community members to provide essential health services and 45.4% of the trained community members prescribe antimalarials. All HCs that reported a VHV prescribing antimalarials use mRDT and prescribe AL. All 76 heath workers who responded to the health facility checklist acknowledged that having community programs like VHV reduced the number of malaria cases presenting to their health facility.

Table 11 Percentage of health centres supporting a village health volunteer (VHV) program and specifications

Question	% (95%CI) of Participants responded 'yes'
Does this health facility support a VHV, CMV, or *Marasin Meri/Man* program? [a]	40.4 (27.5, 54.9)
Does this program include the training and/or supervision of community members to provide primary health care services in their local community? [b]	89.3 (43.9, 98.9)
Have you trained/supervised any community members in the last 12 months?	44.1 (14.4, 78.7)
Do these trained community members prescribe antimalarials? [c]	45.4 (45.4, 45.4)
Do these trained community members prescribe artemether-lumefantrine (e.g., combination therapy? [d]	100 (-)
Do these trained community members administer malaria mRDTs? [d]	100 (-)
In your opinion, has this community program reduced the number of malaria patients presenting to your health facility?	100 (-)

a. Analysis limited to health centres only; b. Analysis limited to health centres who reported supporting a VHV program; c. Analysis limited to health centres who reported training community members to provide basic health care services; d. Analysis limited to health centres who reported a VHV prescribing antimalarials. VHV: Village Health Volunteer, CMV: Community Malaria Volunteer.

3.1.10 WHO Harmonized Health Facility Assessment Malaria Indicators

Table 12 describes the WHO's Harmonized Health Facility Assessment Malaria Indicators.

Table 12 WHO Harmonized Health Facility Assessment (HHFA) Malaria Indicators

Indicators	Type		Overall % (95% CI)
	Health Centres % (95% CI)	Aid Posts [c] % (95% CI)	
Malaria Service Availability [a]			
Percentage of facilities offering any malaria services	100	98.9 (92.6, 99.8)	99.3 (95.4, 99.9)
Percentage of facilities offering malaria diagnosis	100	98.9 (92.6, 99.8)	99.3 (95.4, 99.9)
Percentage of facilities offering malaria diagnosis by clinical symptoms and signs	26.5 (15.4, 41.7)	30.5 (18.5, 46)	29 (21.2, 38.2)
Percentage of facilities offering malaria diagnostic testing	100	98.9 (93.5, 99.8)	99.3 (95.9, 99.8)
Percentage of facilities offering malaria diagnosis by RDT	100	97.8 (91.7, 99.4)	99.3 (95.9, 99.8)
Percentage of facilities offering malaria diagnosis by microscopy	23.3 (12.9, 38.4)	0	8.9 (4.5, 16.9)
Percentage of facilities offering malaria treatment	100	98.9 (92.6, 99.8)	99.3 (95.4, 99.9)
Percentage of facilities offering links with CHWs for malaria services	40.4 (27.7, 54.6)	0	36.3 (23.9, 50.8)
Malaria Service Readiness [b]			
Percentage of facilities offering malaria services with guidelines for diagnosis and treatment of malaria	65.6 (52, 77.1)	34.6 (21.9, 50)	46.6 (36.6, 56.8)
Percentage of facilities offering malaria services with malaria diagnostic testing capacity	100	89.7 (74.2, 96.3)	93.6 (83.6, 97.7)
Percentage of facilities offering malaria services with first-line antimalarials	92.6 (81.7, 97.2)	72.3 (52.1, 86.2)	80.1 (67, 88.9)
Percentage of facilities offering malaria services with paracetamol tab/cap	64.2 (48.9, 77)	50.8 (32.6, 68.7)	55.9 (42.7, 68.3)
Percentage of facilities offering malaria services with sulfadoxine-pyrimethamine (SP) tab/cap	81.7 (67.8, 90.4)	83.5 (69.1, 92)	82.8 (73.3, 89.4)
Percentage of facilities offering malaria services with ITN or vouchers for ITN	10.4 (1.5, 47.4)	86.5 (70.1, 94.6)	39.7 (27.6, 53.2)

a. The denominator is all health facilities (N=76); b. The denominator is the number of health facilities offering a malaria service (N=75); c. One Aid post reported that they are not offering any malaria services.

3.2 Health worker interviews

This section presents the results of health workers' malaria case management-related training, knowledge, attitudes, and practices at the surveyed health facilities. For attitudinal statements, the response options were 'agree', 'disagree' and 'don't know'. The analysis categorised 'Don't know'-responses as 'incorrect'.

3.2.1 Sample characteristics

180 health workers participated in health worker interviews across the four regions and 22 provinces of PNG, including HCs, APs and hospitals. Compared to HCs, APs had fewer health workers employed. Therefore, fewer interviews were conducted at the APs. Fewer health workers were available at the hospitals, while others were involved in COVID-19 clinical care during the survey period. Table 13 presents the number of health workers interviewed at health facilities, including hospitals, by region.

Table 13 Number of health workers by health facility type and region

Health Facility	Region				Total
	Highlands	Islands	Momase	Southern	
Health Centres	27	34	22	34	117 (65.0)
Aid Posts	4	11	5	4	24 (13.3)
Hospital	9	21	4	5	39 (21.7)
Total	40 (22.2)	66 (36.7)	31 (17.2)	43 (23.9)	180 (100)

Table 14 describes the specific characteristics of health workers interviewed at the surveyed facilities. As shown in Table 13, most of the health worker interviews were conducted with community health workers (CHWs), followed by nurses. Over 60% of participating health workers were women. The mean age of the health workers was 41.2 years and on average, health workers had 18 years of clinical experience.

Table 14 Characteristics of the interviewed health workers

Characteristic		Health Centres N=117	Aid Posts N=24	Overall N=141
Qualification n (%)				
	CHW	59 (50.4)	20 (83.3)	79 (56.0)
	HEO	7 (6.0)	0 (-)	7 (5.0)
	NO	51 (43.6)	3 (12.5)	54 (38.3)
	Other	0 (-)	1 (4.2)	1 (<1.0)
Female - n (%)		75 (64.1)	12 (50)	87 (61.7)
Age in years - Mean (SD)		42.1 (12.1)	40.0 (12.9)	41.2 (11.8)
Clinical experience in years - Mean (SD)		18.5 (13.8)	15.9 (13.5)	18.0 (13.7)

CHW=Community Health Worker; NO=Nursing Officer; HEO=Health Extension Officer; Others include Rural Laboratory Assistant, and Medical Laboratory Assistant.

3.2.2 Health workers' malaria-related training and clinical supervision

Table 15 shows the percentage of health worker participants who reported receiving formal malaria-related training and clinical supervision, including malaria case management. The percentage of health workers who reported receiving formal training in the current NMTP was 30% (comparable to the 25% reported in the health facility checklist; see Table 9). However, very few health workers reported that they had received any malaria-related training since 2020. Not many health workers reported (33.7%) receiving any clinical supervision in the past six months at the time of survey. Among these health workers, 82.5% reported that at least one session included supervised observation of malaria case management.

Table 15 Percentage of health workers who reported receiving malaria-related training and clinical supervision

Question: Have you received … in the last six months?	% (95% CI) participants responding 'yes' % (95% CI)
any formal training on current NMTP	30.0 (22.7, 38.5)
any other malaria-related training since 2020	5.5 (2.5, 11.9)
any clinical supervision in the past six months	33.7 (25.2, 43.4)
supervision, including malaria case management observation [a]	82.5 (30.9, 98.1)

a. Of participants who reported having received supervision in the last six months

The health workers from the surveyed hospitals were less likely to have received formal training in the current NMTP compared to the surveyed HCs. Only 18% of 39 health workers from hospitals reported having formal training in the current NMTP. Since 2020, only 13% said they received any malaria-related training. However, more than half of 39 health workers informed that they received clinical supervision, of which 89% included at least one supervised malaria case management observation.

3.2.3 Health workers' malaria case management attitudes

At the interview, all participating health workers were presented with 14 statements designed to measure attitudinal support for the current NMTP. Table 16 listed all the statements, the 'correct' response (i.e., a response considered supportive of the current NMTP) for each statement and the estimated percentage of participants who responded correctly. The estimated mean number of correct responses for 14 statements was 10.1 (95%CI 9.8, 10.4).

The highest percentage of correct responses among the attitudinal statements was identified for malaria testing by mRDT/microscopy by the health workers. Nearly half of the health workers agreed that chloroquine is an effective treatment for uncomplicated malaria. Most health workers recognized the importance of distinguishing *P. falciparum* and *P. vivax* infections before treating uncomplicated malaria. However, more than half of the health workers agreed that *P. falciparum* only causes severe malaria. More than 70% of the health workers responded correctly to most malaria diagnosis and treatment statements. Whereas, for statements related to managing severe malaria cases, approximately half of the health workers answered incorrectly.

The mean number of correct responses from 39 health workers from the surveyed hospitals was 10.5 (SD 1.7). Health workers from the surveyed hospitals responded almost the same as the HCs and AP health workers. However, a greater number of hospital health workers responded correctly to statements related to severe malaria case management compared to health workers from the HCs and APs. See Appendix 1 for each statement's percentages of hospital health workers' correct responses.

Table 16 Percentage of health workers providing the correct response to malaria case management related attitudinal statements

Statement	Correct Response	Participants providing 'correct' response % (95% CI)
All patients who present with fever or suspected malaria should be tested for malaria infection by microscopy or mRDT	Agree	95.7 (91.3, 98.2)
In most cases, chloroquine is an effective treatment for uncomplicated malaria infection	Disagree	51.4 (41.9, 60.7)
Advising patients on how best to avoid mosquito bites is a good use of clinical time	Agree	82 (72.4, 88.8)
In most cases, clinical diagnosis is just as accurate as microscopy or mRDT in detecting malaria infection	Disagree	61.2 (49.4, 71.8)
Fever patients who test negative for malaria infection should still be provided with antimalarial medication as a precautionary measure	Disagree	66.3 (54, 76.8)
Fever patients who were already treated with an antimalarial in the past two weeks should be tested by microscopy but not by mRDT	Agree	60.4 (48.2, 71.5)
It is important to distinguish between vivax and falciparum infection when treating uncomplicated malaria	Agree	86.2 (76.9, 92.1)
Telling patients when to take their medication is less important if written instructions are provided	Disagree	75 (64.3, 83.3)
In most cases, combination therapy is the most effective treatment for malaria infection	Agree	84.7 (75.7, 90.1)
Malaria patients are less likely to complete their medication if the importance of doing so is not communicated to them	Agree	87.7 (79.8, 92.8)
Not all severe malaria patients need admission or referral	Disagree	58.8 (48.9, 68.1)
Severe malaria must be treated with injectable artesunate for a min. of 24h, even if the patient can tolerate oral medication earlier	Agree	76.7 (66.2, 84.6)
Severe malaria patients must still receive AL after being treated with artemether/artesunate injection.	Agree	75.5 (63.7, 84.3)
Only *Plasmodium falciparum* can cause severe malaria	Disagree	49.2 (38.5, 59.9)

3.2.4 Health workers' malaria case management knowledge

Health workers from the health facilities who reported having administered an mRDT prescribed AL or advised a patient to sleep under an LLIN or prescribed IPTp were asked a series of questions designed to test their knowledge in these respective areas. Table 17 presented the number of health workers asked for each question, the questions and the percentage of participants who responded correctly. In addition, the estimated mean number of correct responses for each category is also presented. There was a substantial difference in knowledge among the health workers about mRDT use, AL prescription practice, LLIN use and management, and IPTp prescription practice.

Over 94% of 140 respondents answered correctly for five mRDT knowledge-related questions with an estimated mean number of 4.8. The percentage of health workers responding correctly to AL knowledge-related questions varied for each question type. The highest percentage of correct responses was observed for a question about the time gap between AL first and second doses. The lowest percentage of correct answers given by the health workers was for the question related to a side effect of primaquine that indicates glucose-6-phosphate dehydrogenase (G6PD) enzyme deficiency. More than half of the health workers failed to provide information on the type of food consumed with AL. More than half ranging from 57% to 67% of 140 health workers, indicated limited knowledge of LLIN management, and over 85% of 140 demonstrated good knowledge of LLIN use.

Of 80 health workers who prescribed IPTp, over 95% had good knowledge about the use and dosage of SP.

See Appendix 2 for a table presenting the percentage of participants who responded correctly to the number of questions on mRDT, AL, LLIN and IPTp knowledge and the mean number of correct responses of each category.

Table 17 Percentage of health workers providing the correct responses to malaria case management-related knowledge questions

Question Type	Health workers providing correct response % (95% CI)	Mean (95% CI)
mRDT knowledge: No. of health workers responded [a]	**140**	
Please indicate where blood & buffer are applied on the pictured mRDT test.	95.4 (82.8, 98.9)	4.8 (4.7. 4.9)
How long after applying buffer should you wait before reading an mRDT result?	94.3 (89.5, 96.9)	
Which of the pictured test results indicates malaria infection?	99.6 (96.7, 99.9)	
Which of the pictured test results indicates no malaria (negative) infection?	96.9 (92.1, 98.9)	
Which of the pictured test results indicates an invalid test?	94.4 (88.4, 97.4)	
AL knowledge: No. of health worked responded [b]	**135**	
How many hours after taking the first dose of AL should the second dose be taken?	87.9 (76.5, 94.1)	3 (2.7, 3.2)
What should patients do if they vomit within one hour of consuming the first dose of AL?	64.7 (53.2, 74.7)	
With what type of food should AL be consumed?	44.9 (34.1, 56.3)	
AL is not recommended for treatment with which group of women?	85 (76.9, 90.6)	
When is AL prescribed with PQ, and what side effect of PQ indicates a G6PD deficiency?	24.6 (17.9, 32.7)	
LLIN knowledge: No. of health workers responded [c]	**140**	
Who should sleep under a mosquito net at night?	85.5 (74.8, 92.2)	2.9 (2.6, 3.2)
If there are not enough mosquito nets in the house, which should be prioritized for net use?	95.4 (82.8, 98.9)	
How often should you wash an LLIN?	32.8 (24.7, 42)	
What should you wash an LLIN with?	43.5 (33.7, 53.8)	
How many years does insecticide in LLIN remain effective, assuming good care?	34.2 (26.1, 43.4)	
IPTp knowledge: No. of health workers responded [d]	**80**	
What medicine is recommended for IPTp?	95.7 (82.9, 99)	NA
What dosage of Sulphadoxine/Pyrimethamine (Fansidar®)?	93.6 (74.2, 98.7)	

Only those health workers who reported to have (a) administered an mRDT, (b) prescribed AL, (c) advised a patient to sleep under an LLIN and (d) administered IPTp. The mean number of five questions is presented.

3.2.5 Health workers' malaria case management practices

Table 18 demonstrates the percentages of health workers' malaria case management-related practices, including administering mRDT, prescribing antimalarials like AL and advocating secondary prevention. Of 125 interviewed health workers, 87% reported that they had attended a new case of either fever or suspected malaria in the last fortnight. Most health workers reported having experience administering mRDT and prescribing antimalarials like AL. Few health workers (9% of 102) said they administered antimalarials to patients who tested negative for malaria. The reasons given by these health workers were 'clinical diagnosis of malaria despite test results' and 'prophylactic or as a precautionary measure.

Table 18 Percentage of health workers reported malaria case management practices

Question Type	n	Health workers % (95% CI)
Presented with a new case of fever or suspected malaria in the past 14 days	125	86.9 (78.5, 92.3)
Have tested for malaria infection by mRDT	108	90.8 (77.9, 96.6)
Prescribed antimalarial medication	108	88.1 (81.7, 92.4)
Prescribed artemether-lumefantrine	94	97.7 (91.9, 99.8)
Prescribed antimalarial medication to patients who tested negative for malaria	102	9 (3.7, 20.7)
Advised patients to whom antimalarial was prescribed to avoid mosquito bites	94	90.5 (73.9, 96.9)
Advised patients to whom antimalarials were prescribed to sleep under a mosquito net	94	74.1 (59.3, 84.8)

3.2.6 Health worker's satisfaction with job and health facility

Table 19 displays the estimated proportions of health workers' satisfaction levels with their job, working environment and place of work. These statements were general and not related to malaria. When asked these statements, answers were scored on a scale of 1 to 3, with one being dissatisfied, two neutral, and three satisfied. Nearly 60% of the respondents said they were satisfied with the health facility's management. Less than one-third of the health workers (28.7%) were satisfied with the availability of medicines at health facilities. More than half of the health workers (52.7%) expressed their dissatisfaction with medicines availability. Only 39.5% of the health workers were satisfied with the training opportunities to improve their clinical skills, and 37.2% expressed dissatisfaction. Regarding safety and security in the community to live and work, only 55.3% of health workers were satisfied and one-fifth of them remained neutral and almost one-thirds expressed dissatisfaction. Most of the health workers were generally either satisfied (72.7%) or been neutral (21%) with their job.

The mean numbers of 141 health workers' responses for each statement are also presented in the table below. More number of health workers expressed dissatisfaction regarding

medicines and medical equipment availability, and the physical condition of the health facility building.

Table 19 Percentage of health workers' satisfaction with job and health facility

Question Type	Dissatisfied % (95% CI)	Neutral % (95% CI)	Satisfied % (95% CI)	Mean (95% CI)
Working relationships with other facility staff	21.9 (13, 34.5)	13.2 (9, 18.9)	64.9 (53.5, 74.9)	2.4 (2.2, 2.6)
Management of the health facility	29.5 (19, 42.6)	11.1 (6.7, 17.9)	59.5 (46.8, 70.9)	2.3 (2.1, 2.5)
Availability of medicines at the health facility	52.6 (41.5, 63.4)	18.8 (12.2, 27.8)	28.7 (19.1, 40.6)	1.8 (1.6, 2)
Availability of equipment at the health facility	62.6 (50.6, 73.2)	18 (11.5, 26.9)	19.4 (10.7, 32.6)	1.6 (1.4, 1.8)
The physical condition of the health facility building	45 (34.5, 55.9)	20.1 (12.4, 31)	34.9 (25.4, 45.6)	1.9 (1.7, 2.1)
Health workers' training opportunities to upgrade skills and knowledge	37.2 (26.2, 49.7)	23.3 (16.3, 32.1)	39.5 (28.1, 52.2)	2 (1.8, 2.3)
Safety and security to live and practice in the community	27.6 (19.8, 37.1)	17.1 (11.3, 25.1)	55.3 (45.7, 64.5)	2.3 (2.1, 2.4)
Overall job satisfaction	6.3 (3, 12.8)	21 (13.6, 31.1)	72.7 (62.4, 81.1)	2.7 (2.5, 2.8)

3.3 Febrile case management observations

This section details the passive observation of febrile case management at surveyed health facilities. In this report, an antimalarial prescription was considered compliant with protocol if: AL was prescribed to *P. falciparum* cases; AL + PQ was prescribed to *P. vivax* or mixed malaria infection cases; either AL or AL + PQ was prescribed to any malaria 'positive' case in which the species type was not identified or no antimalarial prescribed to malaria 'negative' cases. The analysis of febrile case management observations done at hospitals was not included in this chapter except for the sample size information.

3.3.1 Sample characteristics

A total of 708 clinical observations were completed across the four regions of PNG, including health facilities and hospitals (see Table 20). Field investigators stayed at each health facility for a day to observe as many fever cases as possible presenting to the health facility on that day, with permission from the patients or guardians. Only few cases of fever or suspected malaria presented at the 32 APs; a substantially higher number of febrile cases were seen at the HCs. In the Highlands Region, fewer cases were seen than in the other regions. In the following paragraphs, the results of 545 clinical observations from HCs and APs are presented.

Table 20 Number of clinical observations by health facility type and region

Health Facility	Region				Total
	Highlands	Islands	Momase	Southern	
Health Centres	74	144	172	147	537 (75.9)
Aid Posts	0	1	6	1	8 (1.1)
Hospital	33	64	20	46	163 (23.0)
Total	107 (15.1)	209 (29.5)	198 (28.0)	194 (27.4)	708

3.3.2 Health workers observed diagnostic & prescription practices

Table 21 describes the proportion of febrile patients tested for malaria infection by mRDT or microscopy, the proportion of malaria-positive patients who received an antimalarial prescription and the percentage of antimalarial prescriptions compliant with current national malaria treatment guidelines. The analysis was limited to patients sent home at the end of the clinical consultation from health facilities. The analysis did not include severe malaria cases either admitted at the health facility or referred to district/provincial hospital. Clinical observations completed at the AP level were also included in the analysis.

The proportion of febrile patients tested for malaria at the facilities was 81.1%. The malaria test-positivity was 37.7% among 456 febrile cases at HCs and APs. Almost all malaria-positive patients were prescribed an antimalarial; 94% were prescribed AL. The NMTP compliance rate of these febrile case management observations was outstanding, with 88.3% compliant observations.

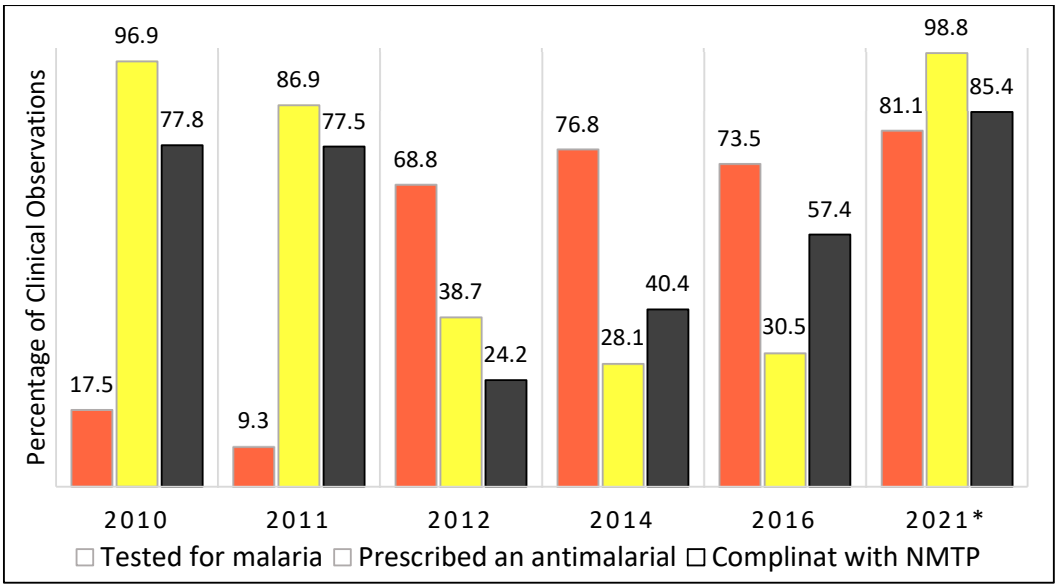
Table 21 Malaria diagnosis and antimalarial prescription practices

Indicator	% (95%CI)
Febrile patients tested for malaria by mRDT or microscopy	81.1 (74.1, 86.5)
Febrile patients tested positive for malaria	37.7 (30.1, 44.9)
Febrile patients who tested positive for malaria were prescribed an antimalarial	98.8 (93.1, 99.8)
Febrile patients who tested positive for malaria were prescribed AL	94.4 (73.9, 98.9)
Clinical observations complied with national guidelines [a]	88.3 (83.7, 91.7)
Antimalarial prescriptions complied with national guidelines [b]	70.4 (57.3, 80.9)

a. Analysis included all clinical observations (n=545). Clinical observations were considered compliant if no antimalarial drug was prescribed to malaria-negative patients and malaria species-specific antimalarial drugs were prescribed according to the national guidelines for malaria-positive patients; b. Analysis limited to observations whenever patients received an antimalarial prescription.

Figure 4 compares the proportions of fever cases presenting to health facilities diagnosed and treated in compliance with the national malaria guidelines. Compared to the previous surveys, in the HFS 2021, health workers complied better with the national guidelines in their testing and treatment practices. Table 23 provides further details of the type of antimalarials based on the diagnosis.

Figure 4 Trend in proportion of fever cases presenting to health facilities diagnosed and treated according to national guidelines



* Weighted proportions

Table 22 illustrates the percentage of observed testing procedures with mRDTs in which health workers adhered to the specified mRDT administration procedures. Health workers highly adhered to five out of eight mRDT administration procedures reflected in the assessment of health workers' knowledge and attitude toward mRDT use (see Tables 15 & 16). These included: using a current (non-expired) RDT test, using an alcohol swab, drawing blood from the finger or heel, applying the blood to the RDT test prior to buffer and applying the blood and buffer in the appropriate sections of the RDT. Health workers did not wear gloves and/or did not write the patient's name on the test during the majority of observed

mRDT procedures. At the same time, health workers were not always patient enough to wait for the suggested time or read it after the suggested time to get accurate results from mRDTs—only 65% of these clinical observations adhered to mRDT-specific result waiting time.

Table 22 Percentage of observations in which health workers adhered to specific mRDT administration procedures

mRDT Procedures	% (95% CI) (n = 281)
mRDT test still current (used prior to expiry date)?	99.7 (98.9, 99.9)
Did the provider put on a new pair of gloves?	23.6 (17.7, 30.8)
Patient's name/ID written on a test?	37.8 (27.1, 49.7)
Patient's finger cleaned with alcohol swab?	96.5 (92.5, 98.4)
Blood is drawn from the patient's finger (heel, OK if baby).	98.7 (95.3, 99.7)
Did blood apply to the mRDT test prior to the buffer?	99.8 (98.3, 99.9)
Blood/buffer applied to appropriate sections of the mRDT test?	98.7 (97.5, 99.3)
mRDT result read 20 minutes or as per instruction of the specific mRDT after buffer applied?	65.1 (57.6, 71.9)

Table 23 describes antimalarial prescription practices by diagnostic test results adhering to the current NMTP. The decision not to refer to diagnostic tests was purely based on the health workers' clinical diagnosis. Without testing, the health workers prescribed AL or a combination of AL and PQ in five observations. Of 545 clinical observations, 89 febrile cases were not offered any malaria diagnosis test.

Of 54 non-compliant antimalarial prescriptions for malaria-positive patients, health workers most often prescribed AL+PQ to *P.f* malaria or failed to combine PQ with AL prescription when treating a non-*P. falciparum* or mixed malaria infection. All malaria-negative patients had not been prescribed any antimalarials except in six cases. Overall, the NMTP compliant rate of these clinical observations was impressive and pertained to the health workers' positive knowledge, attitude and practice toward malaria case management

Table 23 Compliance status and type of antimalarial prescription by diagnostic test result

Diagnostic Test Result [a]		Rating	n	Prescription
No Test (N=89)		Compliant	84	
		Noncompliant	5	AL(3), AL+PQ(2)
Malaria positive (N= 177)	*P. falciparum*	Compliant	24	AL
		Noncompliant	21	AL+PQ(19), SP(2)
	P. vivax, non-P.f	Compliant	24	AL+PQ
		Noncompliant	12	A(1), AL(7), AI(1), SP(1)
	Mixed infection	Compliant	75	AL+PQ
		Noncompliant	21	AL(12), SP(7), AL+A(2)
Malaria negative (N= 264)		Compliant	258	
		Noncompliant	6	AL(5), AL+PQ(1)

a. Out of 545 observations, 89 did not receive any malaria test and 456 tested for malaria. 177 tested positive for malaria and 264 tested negative for malaria. 15 tests were invalid, and no re-test done. A=artemether injection; AL= Artemether-Lumefantrine; AI=Artesunate Injection; PQ=Primaquine; SP=Sulphadoxine-Pyrimethamine.

3.3.3 Observed treatment counselling practices

Treatment counselling is essential for any clinical case management, including malaria. Table 23 illustrates the health workers' practice of malaria treatment counselling. In general, most of the time, health workers provided advice on the AL dosage regimen (e.g., two doses a day for three days), encouraged patients to complete the full course of medication and provided specific advice to take the second dose of AL after eight hours to the first AL dose. However, as reflected in the health worker knowledge table (see Table 17), advice on meal to take with AL was poor. Few patients were instructed to take AL with milk or fatty food or to repeat the initial dose of AL if the patient vomits within one hour of taking it.

Table 24 Percentage of AL prescribed patients who received specific treatment counselling instructions

Instruction **Was the patient/caregiver**	**% (95% CI)** **(n = 177) [a]**
Explained the AL dosage regimen?	97.2 (90.6, 99.2)
Advised to take second dose of AL after 8 hours?	95.6 (87.1, 98.6)
Advised to take AL with milk or fatty food?	34.5 (24.8, 45.8)
Advised to take AL with/after a meal? (n = 120)	62.9 (54.7, 70.6)
Advised what to do if vomiting occurs?	10.1 (4.4, 21.3)
Advised to complete all doses of AL?	97.2 (93.7, 98.8)

a. Analysis restricted to patients who received AL at the health facility

3.4 Exit interviews

At the time of health facility exit, patients were requested to participate in an interview. This section presents the results relating to patients' characteristics, diagnosis status, treatment and service satisfaction, treatment seeking and costs, and medical practices before seeking malaria treatment at health facilities. This section only presents the results from the health facilities. Hospital-based patient interviews are not included in this report.

3.4.1 Sample characteristics

A total of 488 patients and caregivers of sick children participated in the exit interview including health facilities and hospitals. Of 387 interviews at surveyed health facilities, 383 interviews took place at HCs, only four interviews were at the APs (see Table 25).

Table 25 Number of patient interviews by health facility type and region

Health Facility	Region				Total
	Highlands	Islands	Momase	Southern	
Health Centres	41	98	140	104	383 (78.5)
Aid Posts	0	1	2	1	4 (< 1)
Hospital	12	40	18	31	101 (20.7)
Total	53 (10.9)	139 (28.5)	160 (32.8)	136 (27.9)	488 (100)

Table 26 describes the age and sex of patients included in the exit interviews, and their diagnosis status at the health facility they attended. Most patients were 18-year-old or older. 14.2% of patients were children under five years of age.

Nearly half of the interviews were conducted with a patients' caregiver. Of 177 female participants, 48% were caregivers, and of 210 male participants, 56% were caregivers.

Of 340 patients who received a malaria diagnostic test, 244 tested positive for malaria. Almost all (98.8%) of these patients were tested using mRDTs. Most of the patients received a diagnosis at the health facility.

Table 26 Selected characteristics of patients included in the interviews by age and sex, and diagnosis status

Characteristic	Female	Male	Total	Diagnosis received
<5 years	25 (14.1)	30 (14.3)	55 (14.2)	54 (98.2)
5-17 years	60 (33.9)	88 (41.9)	148 (38.2)	129 (87.2)
18 and > years	92 (52)	92 (43.8)	184 (47.6)	157 (85.3)
Total	177 (45.7)	210 (54.3)	387	340 (87.9)

3.4.2 Patients' treatment and service satisfaction

In the interview, patients and caregivers were asked to express their feelings about the facilities and services available and the treatment received. These questions were coded on a scale of 1 to 7 (1–extremely happy, 2–moderately happy, 3–somewhat happy, 4–Neutral,

5–somewhat sad, 6–moderately sad and 7–extremely sad). A range of seven face emojis (an extremely happy face to an extremely sad face) was used to record the participants' feelings. Table 27 presents the estimated mean of patients' responses to each item. Overall, most patients and caregivers were moderately happy about the facilities and services provided at the health facilities.

When asked about service comparison between this and the last visit, most participants (83.8%) responded 'much the same'. Few responded (6.4%) responded that their last visit was better than this malaria-treatment-seeking visit.

Table 27 Mean number of patients' treatment and service satisfaction

Health facility service [a] **How do you feel about…....**	**Mean (95% CI)** **(n = 244)**
Your visit today in general at the health facility?	2 (1.5, 2.6)
The health facility grounds	1.9 (1.5, 2.3)
The health facility buildings	2.5 (1.9, 3.1)
The health facility's toilets	3.5 (2.9, 4)
The health facility's cleanliness	2.3 (1.8, 2.9)
The waiting time for treatment	2.9 (2.1, 3.7)
The cost of treatment	2.3 (1.7, 2.8)
The availability of medicines	2.5 (2.2, 2.9)
The health workers' skills	2 (1.7, 2.4)
The health workers' attitude	2.3 (1.8, 2.8)
The overall service received	2.3 (1.7, 2.8)

(a) Analysis limited to malaria patients diagnosed at health facilities only. The answers to the above questions were recorded on a scale of 1 to 7. 1–extremely happy, 2–moderately happy, 3–somewhat happy, 4–Neutral, 5–somewhat sad, 6–moderately sad and 7–extremely sad. The shaded items are related to malaria treatment.

3.4.3 Patients' Treatment seeking times

Table 28 presents the median time and interquartile range in hours; patients (or their caregivers) reported elapsing between the onset of the first symptom and presenting to the health facility; departing for and arriving at the health facility, and arriving at the health facility, and starting the clinical consultation. As shown, the median wait time between the onset of symptoms and presenting to the health facility was 48 hours. A health worker took approximately 30 minutes to attend to patients at the surveyed facilities. The median travel time for a patient to reach a health facility from home was approximately an hour.

After the first onset of malaria-like symptoms, 23% of participants waited up to 24 hours, and 50% waited up to 48 hours to seek help from health facilities. The reasons reported by the patients who delayed seeking treatment for more than 24 hours were symptoms too mild/not concerned (n=190), distance/lack of transport (n=101), work commitments (n=60), self-treatment at home/elsewhere (n=33), cost of transport/healthcare (n=30), too unwell to travel (n=21) and health facility closed (n=18).

Table 28 Median (Interquartile Range) treatment seeking-related waiting and travel times in hours

Factor	Median number of hours (IQR) (n = 398)
Time between onset of symptoms and seeking treatment	48 (24, 72)
Travel time to health facility (door to door)	1 (0.5, 1.3)
Waiting time to see a health worker	0.5 (0.3, 1.3)

3.4.4 Treatment seeking costs

One-third of the patients/caregivers who participated in the exit interview reported incurring a transport-related cost when travelling to the health facility (see Table 29). The median cost was PNG Kina 2 (ca 0.6 USD) for travelling to the health facility. 28 of 100 participants reported incurring a health facility-related cost while availing of services at the health facility. The median cost was PNG Kina 6 (ca 1.7 USD).

Table 29 Treatment-seeking-related costs in PNG Kina

Factor	(n = 398)
% (95% CI) incurring transport-related costs	36.7 (24.9, 50.3)
Median (IQR) cost in PGK [a]	2 (2, 4)
% (95% CI) incurring health facility-related costs	27.9 (18.9, 39.1)
Median (IQR) cost in PGK	6 (5, 10)

(a) One-way transport cost only

3.4.5 Medication use prior to seeking treatment

Of 387 patients, 4% reported taking an antimalarial before seeking treatment at a health facility. AL was the most frequently reported antimalarial consumed (n=11), and primaquine and chloroquine were mentioned once. The reported source of the antimalarial was an existing home supply (n=5), pharmacy or store (n=4), friends (n=3) or village health volunteer (n=1). In addition, 123 of 387 patients had reportedly taken some ‘other’ form of medication (i.e., other than an antimalarial) before seeking treatment. The most reported ‘other’ drug was some form of analgesic, antipyretic or ‘pain killer’, or an antibiotic. The reported source of these ‘other’ drugs was home supply (n=45), friends (n=47), pharmacy or store (n=31), and village health volunteer (n=1).

4 Discussion and recommendations

This chapter critically discusses the findings from the primary outcome indicators, followed by some principal findings relevant to the NMCP implementation. This chapter also discusses several important recommendations that may benefit stakeholders and policymakers to improve malaria case management strategies.

4.1 Findings from the primary outcome indicators

According to the PNG NMSP, one of the key components of malaria case management activity is to ensure an early and accurate diagnosis.

4.1.1 The proportion of health facilities with working microscopy or mRDT in stock

The result of the first outcome indicator, the proportion of health facilities with working microscopy or unexpired mRDT in stock, at 92.9%, was above the target[2] of 90%. However, six APs were out of stock for mRDTs and waiting for new stock to arrive either from the HC or the provincial medical store. The waiting time reported was up to 10 weeks, even though all the HCs reported to have unexpired mRDTs in stock at the survey time. This finding suggests that there is a need for better communication between HCs and the APs. Generally, the finding points to weaknesses in the supply chain management at the peripheral level.

According to the NMSP, the central public health laboratory (CPHL) will support the maintenance of high-quality microscopy services to monitor severe malaria cases at the hospital level. Though it is not the priority of the CPHL to maintain working microscopes at the HC level, it is good to utilise the resources available locally. At survey time, nine HCs had a functional microscope, and of these, six had all the necessary supplies and personnel to operate them. Seven of nine hospitals were offering microscopy services. However, two hospitals did not have functional malaria microscopy services. This finding suggests a need for better procurement and maintenance strategies at the province and district levels.

4.1.2 The proportion of health facilities with artemether-lumefantrine in stock

The result of the second outcome indicator, the proportion of health facilities with artemether-lumefantrine (at least one blister from any age category) in stock, at 79.6%, was below the target of 90%. However, only 33.7% of health facilities had all four weight-group-specific AL stocks at the survey time. Despite the demand for weight -specific AL dose blisters at health facilities, there is insufficient supply. To overcome such shortages in the supply of weight-group AL blister packs, health workers must continue to be trained to improvise using alternative blister packs as suggested in the NMSP. At the same time, there is an urgent need to improve the supply chain management from central to peripheral level. Since the National Health Information System monthly reporting form was amended to collect detailed antimalarial consumption data from each health facility, health workers are supposed to invest

[2] Outcome indicator targets are as per 2021, Performance Assessment NMSP 2021-2025

substantial efforts every month to record and report their antimalarial drug stocks. Of 14 malaria-positive cases who did not receive AL, eleven cases were observed at the health facilities that reported AL stock outage. This finding suggests the importance of improving antimalarial supply chain. The lack of availability of adequate antimalarial supplies in health facilities suggest that these efforts are either not being made (e.g., due to an excessive amount of reporting requirements and insufficient capacity at health facility level), or that the reported data is not being used to inform adequate re-supply. In either case, the shortages found for malaria drugs are likely to be symptomatic and indicative of other drug stock levels. Urgent attention should therefore be dedicated to improving the system and prevent stock-outs of essential commodities so that health facilities can fulfil their function.

4.1.3 The proportion of health workers trained in NMTP

The proportion of health workers reported by the in-charge of the health facility to be formally trained in the current NMTP was 25%. In health worker interviews, 30% responded that they received training in the current NMTP. However, on both occasions, the field teams neither referred to any specific training program nor a year. When explicitly asked for malaria-related training since 2020, only 5.5% of health workers said they had received training. Even though several stakeholders, like regional malaria coordinators and provincial malaria supervisors, were providing malaria case management training and clinical supervision regularly, the health workers may have failed to recognize these interactions as formal training and may not have reported them on this occasion. This finding suggests that stakeholders providing on-the-job training or supportive supervision may require additional effort to convey the importance of their professional interactions with the health workers.

Malaria case management has become integral to health workers' clinical practice over the years; still, 29% of health facilities were offering malaria diagnosis by clinical symptoms and signs. During clinical observations, five patients without diagnosis and six negative-malaria patients were prescribed an antimalarial. These findings suggest that further extensive training in the national malaria treatment guidelines is worthwhile.

4.1.4 The proportion of febrile cases presenting to health facilities that received a parasitological test

The following outcome indicator, the proportion of febrile cases presenting to health facilities that received either mRDT or microscopy test, at 81.1%, was short of the target of 90%. Nevertheless, the measured coverage is higher compared to previous health facility surveys. The procurement and distribution systems of mRDTs have significantly improved and ensured substantial diagnosis coverage at health facilities. Another positive finding is that the availability and use of mRDTs may contribute to the compliant prescription of antimalarials and minimise clinical diagnosis-based antimalarial prescription practices.

4.1.5 The proportion of confirmed malaria cases that received first-line antimalarial treatment

Another indicator was that the proportion of confirmed cases receiving first-line antimalarial treatment, at 70.4%, was below the target of 90% coverage. Of note, these prescriptions complied with the national malaria treatment guidelines. However, this measure might vary for species-specific malaria cases. Only 24 of 45 cases of *P.f.* infections were prescribed AL. For

non-*P.f.,* 24 of 36 and mixed infections, 75 of 96 were prescribed a combination of AL and PQ. This calculation does not consider the dosage, particularly of PQ, which is required to be taken for 14 days. 88.3% of clinical observations of febrile case management complied with the national guidelines at survey time, when considering both malaria test-positive and test-negative cases. This finding suggests that most health workers are aware of the malaria treatment protocol and practice it. Nevertheless, 30% of first-line antimalarial prescriptions did not comply with the national guidelines. This finding supports the importance of conducting further extensive training in NMTGs.

4.2 Additional findings of potential relevance to the NMCP implementation

4.2.1 The proportion of health facilities providing IPTp to pregnant women

In addition to the above-discussed outcome indicators, providing IPTp to pregnant women during their ANC visits has been prioritized in the NMSP 2021-2025. The proportion of ANC-providing health facilities reportedly offering IPTp to pregnant women was 97%. The availability of SP in all surveyed health facilities was 82.2%. In health worker interviews, over 93% of clinicians (who reported administering IPTp) displayed good knowledge of SP prescription practices at survey time. These findings suggest that most health facilities are equipped with SP stock and knowledgeable clinicians to provide IPTp services to pregnant women.

4.2.2 Health facilities with oral artemisinin monotherapy and non-NMTP antimalarials

According to the Sixtieth World Health Assembly resolution (WHA60.18), oral artemisinin monotherapy (AMT) needed to be withdrawn from all pharmacies and health facilities, including both public and private sectors, to counteract the multi-drug resistant malaria [6]. Despite these recommendations, 34.5% of health facilities had artemether tablets in stock. Furthermore, the PNG malaria treatment policy does not provide antimalarials like amodiaquine, artemisinin-naphthoquine and chloroquine. However, approximately 10% of health facilities reported having these medications in stock during the survey.

4.2.3 Health worker practice and satisfaction

Another critical finding is that health workers reported malaria case management practices and their actual practices during clinical observations. 90.8% of health workers reported having performed mRDT tests for suspected malaria cases with fever, but only 81.1% of such cases were given mRDT tests. Regarding an antimalarial prescription for malaria-positive cases, 88.1% of clinicians reported having prescribed an antimalarial and in actual practice, 98.8% of malaria-positive cases received an antimalarial medication. In addition, few clinicians reported having prescribed an antimalarial to malaria-negative cases, and a similar practice was noted in a few clinical observations. Besides, most clinicians failed to advise patients about dietary requirements while taking antimalarial drugs, specifically AL. It is crucial to make dietary recommendations because lumefantrine is not well absorbed without fat.

Though there is a substantial difference between the reported practice and actual observed practice, it might be the result of observation-related bias. A high proportion of reported practice could result from the social desirability bias (providing a response socially acceptable as opposed to a more honest response) of health workers. The presence of the PNGIMR field team during the clinical observation might influence clinicians' performance.

Health workers are expected to provide reliable advice on malaria prevention activities under the current national guidelines. Such activities include utilization, perceived usefulness, and maintenance of LLINs. This report suggests that most health workers displayed good knowledge of the utilization and perceived usefulness of LLINs. However, health workers' knowledge about LLINs maintenance is limited. Only 32.8% and 43.5% of health workers who advised patients to use LLINs responded correctly to how often and with what an LLIN washed, respectively. As part of the NMCP, millions of LLINs are being distributed across all provinces of PNG free of cost. Health workers with knowledge of LLINs' use and care are assets. Hence, continuing to train health workers to improve such knowledge is a worthwhile activity.

Another interesting finding is the satisfaction levels of health workers with the availability of medicines (28.7%), medical equipment (19.4%), and knowledge and skills upgrading opportunities via clinical training (34.9%) in general. Of note, these questions were not explicitly related to malaria; however, they might affect the malaria service availability and readiness. PNG is known to have an aging and not always well-equipped health workforce, particularly in rural health facilities. Job satisfaction is a key requirement for attracting and maintaining health workers in their job. The low satisfaction found in this survey is therefore a concern not only for malaria case management, but for health service provision in general.

4.2.4 Client experience

In exit interviews, 83.8% of patients who visited the health facility previously responded that the service received during this visit was much the same as the service received on the last visit. Overall, most interviewees were generally moderately happy about their visit to the health facility. The findings from this report suggest that the participants were happy about the malaria-related waiting time, cost of treatment, medicines availability, and health workers' skills and attitude. However, several patients indicated the need for improving the availability of medicines, waiting time, and the health workers' attitudes.

The median travelling time from home to the health facility was 60 minutes, and the average waiting time to be attended by a health worker was 30 minutes. Most of these patients were already suffering from fever, and further delays in diagnosis and treatment might negatively affect patients' treatment-seeking behaviour. In this survey, the patients have delayed seeking treatment from a health facility by 48 hours since the onset of the first symptoms. Providing prompt diagnosis and timely treatment within 24 hours of the onset of first symptoms can reduce malaria progression to severe stages and mortality. Therefore, it is the health worker's responsibility to advocate for the patients about the significance of seeking treatment within 24 hours and avoid any possible delays at the health facilities to offer diagnosis and treatment.

Another finding is the self-medication practices of the patients before seeking help from health facilities. Reducing these practices is difficult but creating awareness through community-based programs using village health volunteers might help.

4.3 Recommendations

Based on the findings of the HFS 2021, the following recommendations are made to effectively implement malaria control activities through formal health facilities in PNG:

- Strengthening of the supply chain management for essential commodities, including the monitoring of procurement, distribution and consumption of antimalarial diagnostics and treatment supplies, to overcome mRDT and antimalarial stock shortages at the HCs and AP levels.
- Continue the regional/provincial malaria coordinators' training activities of health workers with more focus on a) use of mRDTs according to the instructions provided by the manufacturers, b) first-line antimalarial prescription practices based on parasitological diagnosis, c) advocating to the patients the use of AL with fatty food and the proper usage of preventive measures incl. the use and care of LLINs, and d) the counselling practices to improve patients' treatment seeking behaviour.
- Use job aids like wall charts as mRDT user guide and printed treatment guidelines to improve malaria case management effectively.
- Consider the promotion of VHV or CMV programs if the quality of diagnosis and treatment provided through these programmes can be guaranteed and continuous support incl. provision of commodities through health or sub-HCs can be ensured.
- Actively engage health workers in behaviour change communication activities in the communities.
- Conduct another comprehensive health facility survey in 2024 using WHO's malaria harmonized health facility assessment tools to regularly assess malaria case management practices across PNG.

5 References

[1] Papua New Guinea Department of Health. National Malaria Strategic Plan, 2021-25. Strengthening malaria control, moving towards elimination. 2020.

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6 Appendices

Appendix 1: Percentage of hospital health workers providing the correct response to malaria case management-related attitudinal statements

Statement	Correct Response	Participants providing 'correct' response % (95% CI)
All patients who present with fever or suspected malaria should be tested for malaria infection by microscopy or mRDT	Agree	94.9 (80.9, 98.8)
In most cases, chloroquine is an effective treatment for uncomplicated malaria infection	Disagree	43.6 (78, 97.6)
Advising patients how best to avoid mosquito bites is a good use of clinical time	Agree	87.2 (72.1, 94.7)
In most cases, clinical diagnosis is just as accurate as microscopy or mRDT in detecting malaria infection	Disagree	58.9 (42.7, 73.5)
Fever patients who test negative for malaria infection should still be provided with antimalarial medication as a precautionary measure	Disagree	66.7 (50.1, 80)
Fever patients who were already treated with an antimalarial in the past two weeks should be tested by microscopy but not by mRDT	Agree	76.9 (60.6, 87.8)
It is important to distinguish between vivax and falciparum infection when treating uncomplicated malaria	Agree	87.9 (72.1, 94.7)
Telling patients when to take their medication is less important if written instructions are provided	Disagree	76.9 (60.6, 87.8)
In most cases, combination therapy is the most effective treatment for malaria infection	Agree	87.2 (72.1, 94.7)
Malaria patients are less likely to complete their medication if the importance of doing so is not clearly communicated to them	Agree	97.4 (83, 99.7)
Not all severe malaria patients need admission or referral	Disagree	48.7 (33.1, 64.5)
Severe malaria must be treated with injectable artesunate for a min. of 24h, even if the patient can tolerate oral medication earlier	Agree	76.9 (60.7, 87.8)
Severe malaria patients must still receive AL after being treated with artemether/artesunate injection.	Agree	92.3 (78, 97.5)
Only *Plasmodium falciparum* can cause severe malaria	Disagree	51.3 (35.5, 66.8)

Appendix 2: Percentage of hospital health workers providing the correct responses to malaria case management-related knowledge questions

Question Type	Health workers providing correct response % (95% CI)	Mean
mRDT knowledge: No. of health workers responded [a]	38	
Please indicate where blood & buffer are applied on the pictured mRDT test?	97.3 (82.6, 99.7)	
How long after applying buffer should you wait before reading a mRDT result?	71.1 (54.3, 83.5)	4.3
Which of the pictured test results indicates malaria infection?	94.7 (80.5, 98.7)	
Which of the pictured test results indicates no malaria (negative) infection?	94.7 (80.5, 98.7)	
Which of the pictured test results indicates an invalid test?	86.8 (71.3, 94.5)	
AL knowledge: No. of health worked responded [a]	38	
How many hours after taking a first dose of AL should second dose be taken?	73.7 (57, 85.5)	
What should patients do if vomit < one hour of consuming first dose of AL?	60.5 (43.9, 75)	
With what type of food should AL be consumed?	57.9 (41.4, 72.8)	3
AL is not recommended for treatment with which group of women?	81.6 (65.5, 91.2)	
When AL prescribed with PQ, what side effect of PQ indicates a G6PD deficiency?	36.8 (22.8, 53.6)	
LLIN knowledge: No. of health workers responded [a]	34	
Who should sleep under a mosquito net at night?	91.2 (75.1, 97.2)	
If not enough mosquito nets in house, who should be prioritized for net use?	97.1 (80.7, 99.6)	
How often should you wash an LLIN?	20.6 (9.6, 38)	2.3
What should you wash an LLIN with?	41.2 (25.6, 58.7)	
How many years does insecticide in LLIN remain effective assuming good care?	17.6 (7.9, 34.9)	
IPTp knowledge: No. of health workers responded [a]	15	
What medicine is recommended for IPTp?	73.3 (44, 90.6)	NA
What dosage of Sulphadoxine/Pyrimethamine (Fansidar®)?	73.3 (44, 90.6)	

Appendix 3: Surveyed Health Facilities

PROVINCE	DISTRICT	HEALTH FACILITY	HF TYPE	DATE [a]
Autonomous Region of Bougainville	Buka North	Elutupan	AP	11/11/2021
		Lemanmanu	HC	12/11/2021
Central	Kairuku-Hiri	Vesulogo	AP	20/04/2022
		Ogotana	AP	21/04/2022
		Sogeri	HC	22/04/2022
	Rigo	Kak	HC	26/04/2022
Chimbu	Kundiawa	Wandi	SC	08/09/2021
		Mongoma	AP	10/09/2021
		Goglme	HC	14/09/2021
East New Britain	Gazelle	Napapar	SC	02/12/2021
	Rabaul	Sikut Talvat	AP	14/12/2021
		Cliffton	AP	15/12/2021
		Gelagela	SC	16/12/2021
East Sepik	Yangoru-Saussia	Papandu	AP	06/10/2021
		Naksimigel	SC	06/10/2021
		Warabung	AP	08/10/2021
	Wosera Gawi	Konapandu/Kuanjiviak	AP	13/10/2021
		Wombisa	HC	13/10/2021
Eastern Highlands	Daulo	Asaro	HC	24/02/2022
	Obura-Wonenara	S.I.L.	UC	01/03/2022
Enga	Kompian-Ambun	Yampu	HC	10/09/2021
	Wapenamanda	Wapenamanda	UC	24/09/2021
Gulf	Kerema	Malalaua	HC	16/11/2021
	Kikori	Koravake	AP	03/12/2021
		Baimuru	HC	04/12/2021
Hela	Tari/Pori	Hiwanda	HC	30/09/2021
	Komo/Magarima	Mananda	AP	06/10/2021
		Komo	HC	06/10/2021
		Ajageiba	AP	07/10/2021
Jiwaka	Anglimp/South Waghi	Kindeng Coffee	AP	10/02/2022
		Kindeng	HC	11/02/2022
	North Waghi	Norba	SC	14/02/2022
		Milep	AP	15/02/2022
		Numbkora	AP	18/02/2022
Madang	Middle-Ramu	Bibuwai	AP	07/03/2022
	Usino-Bundi	Dumpu	AP	09/03/2022
		Sausi	SC	02/03/2022
		Gusap	HC	11/03/2022
Manus	Lorengau	Lorengau East	UC	08/04/2022
		Tulu Aidpost	AP	14/04/2022
		Bundralis	HC	14/04/2022

[a] Date of health facility checklist. AP=Aid Post, HC=Health Centre, SC=Sub Health Centre, UC=Urban Clinic

PROVINCE	DISTRICT	HEALTH FACILITY	HF TYPE	DATE [a]

Milne Bay	Alotau	Gabugabuna	AP	18/05/2022
		Hagita Estate Clinic	SC	18/05/2022
		Gurney	HC	20/05/2022
		Wogahuhu	AP	24/05/2022
		East Cape	HC	24/05/2022
Morobe	Lae	Mary Queen of Peace	AP	17/03/2022
		Malahang	HC	18/03/2022
	Bulolo	New Camp	AP	29/03/2022
		Bulolo	HC	29/03/2022
		Bulolo Uni Clinic	AP	30/03/2022
NCD	Moresby South	Four Square/Kaugere	UC	08/10/2021
	Moresby Northwest	St.Theresa	UC	13/10/2021
New Ireland	Kavieng	Lemakot	HC	27/04/2022
		Madina Community	AP	29/04/2022
	Namatanai	Mapua	SC	04/05/2022
Northern	Ijivitari	Sinapa	AP	07/02/2022
		Wanigela	SC	09/02/2022
		Tufi	HC	16/02/2022
Sandaun	Vanimo-Green River	Bewani	HC	08/09/2021
		Amanab 56	AP	09/09/2021
		Krisa	AP	10/09/2021
		Laitre	HC	21/09/2021
Southern Highlands	Mendi	Mendi	UC	24/11/2021
	Ialibu-Pangia	Muli	SC	02/12/2021
West New Britain	Talasea	Tamba	AP	27/04/2022
		Laheri	AP	28/04/2022
		Kimbe	UC	28/04/2022
		Mosa (Nbol)	HC	02/05/2022
		Dami Research Station	AP	03/05/2022
		Kumbango Oil Mill	AP	04/05/2022
Western	North Fly	Yenkenai	AP	23/03/2022
		Matkomnai	SC	25/03/2022
	Middle Fly	Balimo	UC	06/04/2022
Western Highlands	Tambul-Nebilyer	Tambul	HC	02/03/2022
		Tomba	HC	16/03/2022

[a] Date of health facility checklist. AP=Aid Post, HC=Health Centre, SC=Sub Health Centre, UC=Urban Clinic

Appendix 4: Names of contributors

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