Papua New Guinea Institute of Medical Research

Papua New Guinea/The Global Fund Round 8 Malaria Control Program Evaluation 2009-2014:

Summary Report of the 2010, 2011 & 2012 Countrywide Health Facility Surveys

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June7th2013

INTRODUCTION

The Papua New Guinea Institute of Medical Research (PNGIMR) conducts repeated cross sectional health facility surveys (HFS) as a part of their monitoring and evaluation (M&E) activities in support of the National Malaria Control Program (NMTP). The primary objectives of each HFS are to assess the availability of diagnostic tools, medicines and human resources as well as the quality of malaria case management. The main outcome measures include:

1. Proportion of health facilities with working microscopy or with malaria Rapid Diagnostic Tests (RDT) in stock
2. Proportion of health facilities with artemether-lumefantrine(AL) in stock (for all age groups)
3. Proportion of health care providers trained in malaria case management (new treatment guidelines and use of RDTs)
4. Proportion of fever cases presenting to health facilities diagnosed and treated according to national guidelines

Three countrywide HFS have been conducted to date, in 2010, 2011 and 2012 and a fourth is scheduled for completion in 2014. This report presents summary data from the three completed surveys on the four outcome indicators described above. A small amount of additional data is also reported, although more detailed analyses of the 2011 and 2012 datasets will follow. Detailed findings from the first of these surveys (2010) have previously been reported (Pulford et al, 2011).

METHODOLOGY

Study Sites

Each HFS was carried out country-wide (all provinces) in areas with endemic or potentially epidemic malaria. Each HFS sample consisted of two Urban Clinics (UC), Health Centres (HC) or Health Sub-Centres (SC) (collectively referred to as HC in this report) and up to four Aid Posts (AP)selected from each province using a simple random sampling procedure. Sampling frame was a list of all operational HC provided by the National Department of Health.

Survey Procedure

The surveys were carried out from June to November 2010, June to November 2011 and May to November 2012, respectively. Survey team members spent between three to five days at each participating HC and up to one day at each participating AP. Four distinct survey instruments were utilised (when possible) at each site: 1) a health facility checklist completed with the officer in charge of the health facility; 2) an

interviewer administered questionnaire completed with clinical staff at each participating health facility; 3) an interviewer administered questionnaire completed with fever or suspected/confirmed malaria patients at the end of their clinical consultation; and 4) a clinical assessment instrument which involved non-participant observation of the clinical case management of fever or suspected malaria patients. The health facility checklist was only completed once at each site whilst the remaining three instruments were completed as many times as possible. The survey process was approved and granted ethical clearance by the Medical Research Advisory Committee of PNG (MRAC No. 10.12; 26 Feb 2010).

Survey Instruments

As noted, four survey instruments were completed (some multiple times) at each participating health facility. This report presents data from only two of these instruments: the health facility checklist and the non-participant clinical observation. Data from the remaining instruments will be presented in subsequent reports.

Health Facility Checklist

This instrument assesses the human resource capacity and the availability of supplies relevant to the treatment and management of malaria. Key questions include the number of clinical staff employed, the number of clinical staff trained in the new NMTP, the quantity of RDTs and AL in stock, the quantity of functional microscopes and availability of essential microscopy supplies, and the availability of a range of anti-malarial medications.Recorded numbers of clinical staff and staff trained in the new NMTP are based on figures provided by the officer in charge.All reported RDT stock, microscopes, including microscopy supplies essential to operation – Giemsa stain, slides and (in the case of electric microscopes) power supply – anti-malarials, and other reported medical equipment or supplies are observed by the respective PNGIMR field team leaders. This instrument is designed to measure the following primary outcome indicators: proportion of health facilities with working microscopy or with malaria RDT in stock; proportion of health facilities with ALin stock (for all age groups); and the proportion of health care providers trained in malaria case management (treatment guidelines and RDTs).

Observation of Clinical Care

A checklist designed to assess the quality of malaria case management. The PNGIMR field teams use this checklist to assess whether specified clinical actions do or do not occur and to record the content of specific actions (e.g. whether an RDT was conducted or a referral was made and, if yes, what was the outcome?). This instrument is designed to measure the outcome indicator: proportion of fever cases presenting to health facilities diagnosed and treated according to national guidelines.

Data Analysis

Data from each survey were double entered into DMSys version 5.1. Data analysis was performed using Intercooled Stata version 9 (2010) and Stata/SE version 12 (2011, 2012). The calculation of CIs was adjusted for possible clustering at the health facility level where required.

RESULTS

Sample Characteristics

Table 1.Number ofsurveyed health facilities by year, health facility type and region

Year	Health Facility Type	Region				Total
		Southern	Highlands	Momase	Islands	
2010	Health Centres	12	10	8	10	40
	Aid Posts	13	7	8	11	39
2011	Health Centres	15	11	9	11	46
	Aid Posts	11	6	10	15	42
2012	Health Centres	15	11	8	7	41
	Aid Posts	16	11	10	10	47
Total		**82**	**56**	**53**	**64**	**255**

Table 2. Number of clinical observations by year, health facility type and region[1]

Year	Health Facility Type	Region				Total
		Southern	Highlands	Momase	Islands	
2010	Health Centres	121	106	117	106	450
	Aid Posts	5	4	6	3	18
2011	Health Centres	144	110	192	165	611
	Aid Posts	4	1	14	4	23
2012	Health Centres	132	114	127	66	439
	Aid Posts	5	0	0	1	6
Total		**411**	**335**	**456**	**345**	**1547**

1. These totals include new fever cases only; treatment review patients were excluded from analysis

Primary Outcome Measures

Table 3.Percentage of health facilities with unexpired RDT in stock, working microscopy available, or either unexpired RDT/working microscopy by year

Year	Diagnostic Test	Health Centres		Aid Posts		Overall	
		%	(95% CI)	%	(95% CI)	%	(95% CI)
2010	RDT	17.5	(7.3, 32.8)	0	-	8.9	(3.6, 17.4)
	Microscopy[a]	12.5	(4.2, 26.8)	0[b]	-	6.3	(2.1, 14.2)
	RDT or microscopy	30.0	(16.6, 46.5)	0	-	15.2	(8.1, 25.0)
2011	RDT	19.6	(9.4, 33.9)	7.1	(1.5, 19.5)	13.6	(7.2, 22.6)
	Microscopy[a]	15.2	(6.3, 28.9)	0	-	8.0	(3.3, 15.7)
	RDT or microscopy	32.6	(19.5, 48.0)	7.1	(1.5, 19.5)	20.5	(12.6, 30.4)
2012	RDT	90.2	(76.9, 97.3)	21.3	(10.7, 35.7)	53.4	(42.5, 64.1)
	Microscopy[a]	7.3	(1.5, 19.9)	2.1	(<0.1, 11.3)	4.6	(1.3, 11.2)
	RDT or microscopy	90.2	(76.9, 97.3)	21.3	(10.7, 35.7)	53.4	(42.5, 64.1)

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

Table 4. Percentage of health facilities with artemether-lumefantrine(AL) in stock[1]

Year	AL Dose	Health Centres		Aid Posts		Overall	
		%	(95% CI)	%	(95% CI)	%	(95% CI)
2010	Infant (5-15kg)	0	-	0	-	0	-
	Child (15-25kg)	0	-	0	-	0	-
	Youth (25-35kg)	0	-	0	-	0	-
	Adult (35+ kg)	0	-	0	-	0	-
	All doses	0	-	0	-	0	-
2011	Infant (5-15kg)	13.0	(4.9, 26.3)	0	-	6.8	(2.5, 14.3)
	Child (15-25kg)	13.0	(4.9, 26.3)	0	-	6.8	(2.5, 14.3)
	Youth (25-35kg)	13.0	(4.9, 26.3)	0	-	6.8	(2.5, 14.3)
	Adult (35+ kg)	8.7	(2.4, 20.8)	0	-	4.6	(1.3, 11.2)
	All doses	8.7	(2.4, 20.8)	0	-	4.6	(1.3, 11.2)
2012	Infant (5-15kg)	95.1	(83.5, 99.4)	21.3	(10.7, 35.7)	55.7	(44.7, 56.3)
	Child (15-25kg)	92.7	(80.1, 98.5)	23.4	(12.3, 38.0)	55.7	(44.7, 56.3)
	Youth (25-35kg)	92.7	(80.1, 98.5)	19.2	(9.1, 33.3)	53.4	(42.5, 64.1)
	Adult (35+ kg)	92.7	(80.1, 98.5)	23.4	(12.3, 38.0)	55.7	(44.7, 56.3)
	All doses	87.8	(73.8, 95.9)	19.2	(9.1, 33.3)	51.1	(40.2, 61.9)

1. 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 packof the respective anti-malarial in stock.

Table 5. The number and percentage of clinical staff employed in the surveyed health facilities who had been trained in the new NMTP

Year	Position	No. Employed	Trained in new NMTP	
			n	%
2010	MD	3	0	0
	HEO	16	1	6.3
	Nurse	144	9	6.3
	CHW	263	19	7.2
	RLA/MLA	17	0	0
	Total	**443**	**29**	**6.5**
2011	MD	3	3	100
	HEO	25	22	88
	Nurse	180	153	85
	CHW	306	246	80.4
	RLA/MLA	14	12	85.7
	Total	**528**	**436**	**82.6**
2012	MD	7	3	42.9
	HEO	19	17	89.5
	Nurse	175	111	63.4
	CHW	308	218	70.8
	RLA/MLA	12	10	83.3
	Total	**521**	**359**	**68.9**

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

Table 6.Proportion of fever cases presenting to a health sub-centre, health centre or urban clinic diagnosed and treated according to the new national malaria treatment protocol[1]

Year	No. Fever Patients	% Tested RDT/MS[2]	% Prescribed Anti-malarial	% Prescribed AL[3]	% Protocol Compliant[4]
2010	450	17.1	96.4	0	0
2011	611	9.8	87.5	0.4	3.3
2012	439	68.6	38.4	12.5	45.8

1. Restricted to patients observed at health facilities above aid-post level. 2. RDT = rapid diagnostic test, MS = microscopy. 3. AL = artemether-lumefantrine. 4. Protocol compliant = tested by RDT or MS and prescribed AL if test positive or given no anti-malarial prescription if test negative.

Supplementary 2012 Data

Table 7.Percentage of health facilities with the required anti-malarial medication for implementation of the new national malaria treatment protocol.

Medication[a]	**Health Centre**		**Aid Post**		**Overall**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
AL[b,c]	87.8	(73.8, 95.9)	19.2	(9.1, 33.3)	51.1	(40.2, 61.9)
AL + PQ[d]	68.3	(51.9, 81.9)	14.9	(6.2, 28.3)	39.8	(29.5, 50.1)
DP[e]	4.9	(<0.1, 16.5)	0	-	2.3	(<0.1, 8.0)
AI + AL[f]	70.7	(54.5, 83.9)	8.5	(2.4, 20.4)	37.5	(27.4, 48.5)
AI + AL + PQ[g]	61.0	(44.5, 75.8)	8.5	(2.4, 20.4)	33.0	(23.3, 43.8)
QI + QT + DX[h]	65.9	(49.4, 79.9)	29.8	(17.3, 44.9)	46.6	(35.9, 57.5)

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 anti-malarial in stock. b= Measured as the presence of blister packs in all four weight categories. c= First line treatment for uncomplicated *P.falciparum* infection. d= First line treatment for uncomplicated *P.vivax* infection. e= Second line treatment for uncomplicated malaria infection. 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 8. Percentage of febrile patients tested for malaria infection by blood slide or RDT in health facilities with RDT or microscopy available (n=35) and overall (n=43).

Test Type	**Health Facilities with RDT or Microscopy Available**		**All Health Facilities**	
	%	95% CI	%	95% CI
Blood slide	<1	-	<1	-
RDT	73.3	(55.7, 85.7)	68.3	(52, 81.1)

Table 9. Number and percentage of observed fever patients prescribed an anti-malarial by diagnostic category and overall.

Diagnostic Category	**Any Antimalarial**			**Recommend Antimalarial**		
	n	%	95% CI	n	%	95% CI
No RDT/microscopy conducted	134	51.5	(28.6, 73.8)	139	1.5	(<0.1, 11.4)
Positive RDT/microscopy result	54	98.2	(84.1, 99.8)	54	98.2	(84.1, 99.8)
Negative RDT/microscopy result	248	19.4	(9.6, 35.1)	250	<1	(<0.1, 2.7)
Overall	**438**	**39**	**(27.8, 51.7)**	**445**	**12.6**	**(7.2, 21.1)**

Secondary Outcome Measures

Table 10. Observed treatment counselling practices[1]

Instruction	**2010**		**2011**		**2012**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Purpose of medication	63.4	(58.7, 68.0)	74.7	(70.6, 78.5)	71.6	(64.2, 78)
Dosage/regimen	75.7	(71.5, 79.7)	94.6	(92.2, 96.4)	86	(74.8, 92.7)
Dietary	6.2	(4.2, 08.9)	6.3	(4.3, 8.8)	17.5	(10, 29)
Possible adverse effects	1.1	(0.3, 2.6)	3.8	(2.3, 5.9)	3.7	(1.4, 9.4)
HF re-engagement[2]	27.7	(23.6, 32.1)	23.5	(19.9, 27.5)	21.1	(11.9, 34.5)
Prevention advice	10.3	(7.6, 13.5)	16.9	(13.7, 20.6)	21.9	(12.1, 36.3)

1. Sample restricted to patients who had been prescribed antimalarial medication. 2. In which patients are advised to return to the health facility if current symptoms persist or deteriorate.

Table 11.Anti-malarial medications in stock in surveyed health facilities

Medication	**2010**		**2011**		**2012**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Amodiaquine	89.9	(81.0, 95.5)	98.9	(93.8, 99.9)	89.8	(81.5, 95.2)
Artemisinin-naphthoquine	2.5	(0.3, 8.9)	1.2	(<0.1, 6.2)	6.8	(2.5, 14.3)
Artemether injections	49.4	(37.9, 60.1)	60.2	(49.2, 70.5)	59.1	(48.1, 69.5)
Artemether tablets	53.2	(41.6, 64.5)	46.6	(35.9, 57.5)	54.6	(43.4, 65.2)
Artesunate injections	24.1	(15.1, 35)	12.5	(6.4, 21.3)	21.6	(13.5, 31.6)
Artesunate suppositories	2.5	(0.3, 8.9)	-	-	12.5	(6.4, 21.3)
Chloroquine	88.6	(79.5, 94.7)	90.8	(82.7, 95.9)	88.6	(80.1, 94.4)
Dihydroartemisinin-piperaquine	2.5	(0.3, 8.8)	1.1	(<0.1, 6.2)	2.3	(<0.1, 8.0)
Doxycycline	70.9	(59.6, 80.6)	88.5	(79.9, 94.3)	85.2	(76.1, 91.9)
Sulphadoxine/Pyrimethamine	86.1	(76.5, 92.8)	82.8	(73.2, 90.0)	92.1	(84.3, 96.7)
Atovaquone-proguanil	3.9	(0.8, 11)	3.5	(<0.1, 9.7)	0	-
Primaquine	73.1	(61.8, 82.5)	79.6	(69.6, 87.4)	81.8	(72.2, 89.2)
Quinine injections	62.0	(50.4, 72.7)	53.4	(42.5, 64.1)	54.6	(43.6, 65.2)
Quinine tablets	82.3	(72.1, 90.0)	76.1	(65.9, 84.6)	80.7	(70.9, 88.3)

Table 12.National Malaria Treatment Protocol 'job aids' in stock in surveyed health facilities[1]

Resource	**2011**		**2012**	
	%	(95% CI)	%	(95% CI)
RDT User Guide (wall chart)	37.5	(27.4, 48.5)	56.8	(45.8, 67.3)
PNG Malaria Treatment Protocol (wall chart)	7.8	(3.3, 15.7)	47.7	(37.0, 58.6)
Preventing Malaria in PNG (flip chart)	8.1	(3.3, 15.9)	40.2	(29.9, 51.3)
Talking about Malaria Treatment (poster)	9.1	(4.0, 17.1)	47.1	(36.3, 58.1)
Talking about Mosquito Nets (poster)	6.8	(2.5, 14.3)	50.6	(39.6, 61.5)
Talking about Malaria Testing (poster)	6.8	(2.5, 14.3)	52.9	(41.9, 63.7)

1. Listed resources were not assessed in the 2010 survey.

Table 13.Availability of selected medical equipment and resources in surveyed health facilities.

Resource[1]	**2010**		**2011**		**2012**	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Thermometer	97.5	(91.2, 99.7)	94.3	(87.2, 98.1)	97.7	(92.0, 99.7)
Body weight scale (infant)	60.8	(49.1, 72.6)	65.9	(55.0, 75.7)	61.4	(50.4, 71.6)
Body weight scale (adult)	84.8	(75.0, 91.9)	94.3	(87.1, 98.1)	88.6	(80.1, 94.4)
BP[2] machine (infant)	11.4	(5.3, 20.5)	4.6	(1.3, 11.2)	2.3	(<0.1, 8.0)
BP machine (adult)	55.7	(44.1, 66.9)	58.0	(47.0, 68.4)	50.0	(39.1, 60.9)
10 step IMCI checklist[3]	54.4	(42.8, 65.7)	60.2	(49.2, 70.5)	60.2	(48.9, 70.8)
Treatment manual (child)	94.9	(87.5, 98.6)	93.2	(85.7, 97.5)	93.2	(85.7, 97.5)
Treatment manual (adult)[4]	-	-	85.2	(76.1, 91.2)	78.8	(68.6, 86.9)

1. Only working thermometers, body weight scales and BP machines were counted. 2 BP = blood pressure. 3. Only IMCI wall charts were counted. 4. The adult treatment manual was not included in the 2010 survey

Table 14. Percentage of cases in which each of eight recommended steps involved in administering malaria RDT were observed

Activity	**% Observed Cases**[a]		
	2010 (n=82)	2011 (n=40)	2012 (n=379)
Use of unexpired RDT	68	87	89
Provider put on a new pair of gloves	51	36	45
Patient name written on test	53	28	36
Patient's finger cleaned with alcohol swab	98	100	99
Blood drawn from patient's finger (or heel if baby)	100	100	96
Blood applied to RDT test prior to buffer	98	97	97
Blood and buffer applied to appropriate sections of RDT test	95	97	99
RDT test read 15 minutes after buffer applied	84	48	64
All steps observed	**30**	**21**	**17**

a. n=total number of cases in each HFS in which an RDT was administered and observed.

DISCUSSION

Primary Outcome Measures

The reported findings indicate that, since the new NMTP was implemented in November 2011, the availability of RDTs and AL has improved substantially at the urban clinic, health centre and heath sub-centre levels. However, the remaining anti-malarial medications included in the new NMTP are less available and the availability of all recommended diagnostic tools and anti-malarial medications remains low at the aid post level.

The training of the health workforce was reasonably comprehensive with over 80% of clinical staff employed at surveyed health facilities in 2011 reportedly trained in the new NMTP. However, this figure dropped to approximately 70% during the 2012 survey suggesting some loss in the proportion of trained staff in the period immediately following NMTP implementation.

Just under half of the febrile patients (45.8%) observed in 2012 were treated in accordance with the new NMTP, yet this relatively low adherence rate somewhat masks the substantial changes observed in malaria case management across the survey periods. The use of RDTs or microscopy increased from 17.1% of fever patients to 68.6% and anti-malarial prescription decreased from 96.4% to 38.4%. Similarly, data from 2012 indicate that fewer than 20% of RDT or microscopy test negative cases are prescribed an anti-malarial. These findings suggest health workers are adapting their malaria case management practice in line with the new treatment protocol, even if not always fully adhering to it. However, the change in presumptive malaria diagnosis when RDT or microscopy were not conducted (presumptive diagnoses halved in this circumstance between 2010 and 2012) warrants careful consideration. This reduction in presumptive diagnosis could indicate a more refined use of clinical judgement on the health workers' behalf or a reluctance to prescribe anti-malarials in the absence of a diagnostic test. The latter, if it is the case, is not necessarily best clinical practice.

Secondary Outcome Measures

The quality of treatment counselling has remained relatively poor across the survey period, despite its supposed emphasis in the NMTP heath worker training. In particular, health workers rarely advise patients of the potential side effects of medication, rarely encourage patients to re-engage with the health facility if their symptoms do not improve or worsen and rarely provide potentially useful health promotion advice such as ‘malaria can be prevented by sleeping under a mosquito net’.

Job aids were often only present in half of the health facilities surveyed. Treatment manuals, thermometers and adult body weight scales were widely available, but other useful resources such as the IMCI wallchart or infant scales were often absent.

A relatively wide range of antimalarial medications were available in many health facilities across the survey periods. Obsolete first line antimalarialsamodiaquine and chloroquine were still widely available in 2012, yet recommended first line medications other than AL, such as artesunate injections and Dihydroartemisinin-piperaquine, were relatively rare.The findings also suggest, when health workers choose to prescribe anti-malarials to test negative cases, they prescribe the obsolete non-recommended medications (e.g. chloroquine, SP, artemether). This practice is less than ideal as the continued use of these medications may compromise the efficacy of SP and AL. The quality of RDT administration was consistent across time periods and the core technical requirements were widely observed. However, the use of gloves, recording of the patient’s name on the test and reading the test after 15 minutes were less well observed.

Survey Limitations

The HFS was designed to collect data representative at a national level. Accordingly, the reported findings should not be generalised to the provincial level. The surveys were conducted during periods of low malaria transmission (June-November) in those provinces with seasonal variation. Thus, the number of malaria patients presenting to health facilities and the subsequent pressure on resources (e.g. RDT kits, anti-malarial

medication) may have been lower during the survey periods as opposed to peak transmission periods. It is also possible that health workers may treat patients differently in low and high transmission seasons depending on what they perceive the most likely cause of fever to be. Participating clinicians were aware that they were being observed and may have altered their clinical practice accordingly (i.e. the observed treatment practice may not have been representative of routine treatment practice). The expected effect of any such bias would be towards perceived 'better' practice.

Reference

Pulford J, Kurumop S, Hetzel MW, Mueller I & Siba P. *Papua New Guinea/The Global Fund Round 8 Malaria Control Program Evaluation 2009-2014: Report of the Baseline Health Facility Survey 2010*. Goroka (PNG): Papua New Guinea Institute of Medical Research. May 2011.

Acknowledgements

The authors gratefully acknowledge the many health workers and patients who gave their time to participate in this study. The generous support of the provincial and district health authorities and the national department of health are also acknowledged. The surveys were conducted with financial support from the Global Fund to Fight AIDS, Tuberculosis and Malaria.

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