



a decade in communicable disease control and child health

## Consultancy Report

# Assessment of Malaria Surveillance in Myanmar



Malaria Consortium  
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## ABBREVIATIONS

3MDG	Three Millennium Development Goals Fund
ABER	Annual blood examination rate
API	Annual parasite incidence
BHS	Basic health staff
GF	Global Fund to Fight AIDS, Tuberculosis and Malaria
HA	Health assistant
HMIS	Health Management Information System
ITN	Insecticide treated nets
LLIN	Long lasting insecticidal nets
MARC	Myanmar Artemisinin Resistance Containment
M&E	Monitoring and evaluation
MW	Midwife
MIS	Management Information System
MIMU	Myanmar Information Management Unit
MOH	Ministry of Health
NGO	Non-governmental organization
INGO	International non-governmental organization
NMCP	National Malaria Control Programme
PSI	Population Services International
PHIS	Public Health Information System
RHC	Rural health centre
RDT	Rapid diagnostic test
SCF	Save the Children Myanmar
SC	Sub-centre
SH	Station hospital
SPR	Slide positivity rate (blood slides only)
TH	Township hospital
TMO	Township Medical Officer
TPR	Test positivity rate (blood slides and rapid diagnostic tests)
UNOPS	United Nations Office for Project Services
UHC	Urban health centre
VHV	Village health volunteer (formerly, volunteer health worker; VHW)
VBDC	Vector Borne Diseases Control
WHO	World Health Organization

## SUMMARY

In recent years the Vector Borne Diseases Control Program (VBDC) has made significant progress in strengthening malaria surveillance in Myanmar. This has involved developing vertical reporting systems for both government health facilities and Village Malaria Volunteers (VHVs) and using both paper-based and electronic methods for compiling and submitting data reports. Under the Myanmar Artemisinin Resistance Containment (MARC) framework, a pilot project is ongoing to test the feasibility of village-specific case-based reporting, which VBDC has set as long-term national goal.

The primary aim of this assessment is to evaluate current approaches to malaria surveillance in Myanmar and to provide a set of practical and feasible recommendations to further strengthen the surveillance system in the short to medium term. The assessment focuses on the surveillance of malaria cases (as distinct from more general surveillance to support monitoring and evaluation) and, more specifically, on instruments and systems to collect, collate, report and analyze malaria data as a basis for informing malaria control policy and practice. This report describes the flow (and use) of information from volunteers and government health staff at all levels of the system to the central level and makes a number of detailed recommendations to improve the system and to address some of the bottlenecks and issues identified. The report also includes an assessment of available surveillance data for 2012 and based on this analysis makes recommendations aimed at maximizing the coverage and utility of the existing surveillance system. Based on this analysis it is apparent that the VHV network represents an important opportunity to effectively increase the coverage of the surveillance system but that an immediate priority is to improve the completeness of the VHV dataset and to develop system for tracking reporting rates.

The progress being made towards case based reporting in Myanmar is very encouraging given the obvious constraints in many areas including funding, manpower, logistics and technical capacity. The system works well at the lower levels and the volume, detail and quality of data being reported by VHVs, midwives and other government health staff is impressive. Overall, the paper-based data collection element of the system is well designed and appropriate for the capacity of the health staff. The case registers provide all data that the national program requires and are well understood by the volunteers and basic health staff that use them. Although some issues of incorporating VHV data still need to be addressed, the flow of the paper based reports works well and in a reasonably timely way considering the many potential constraints mentioned above.

Given the large amounts of data flowing into the system the priority areas to be addressed relate to how these data are managed and by whom. The current system through which data are entered into spreadsheets at the state/region or township level is clearly stressed and ultimately unsustainable. The EXCEL spreadsheets cannot handle large amounts of case data efficiently and do not represent a suitable platform for

analyzing these data, examining patterns of reporting or providing appropriate feedback. Sending the spreadsheets up the chain of supervision is also challenging given the size of the associated files and combining and manipulating the data national level represents a major challenge for staff at WHO and NMCP.

These current technical issues can be addressed relatively easily through the introduction of a database to replace the EXCEL spreadsheets at central, state/region and township levels. This was a medium term aim for NMCP but given the dysfunctional nature of the spreadsheet system this report recommends that the task be undertaken as soon as possible. If there is a significant delay in this the program runs the risk falling back to a reliance on the paper based system and missing out on the benefits of computerization. It is important to note that it is inevitable that the malaria surveillance system will be computerized at some point and the recommendations in this report are intended to ensure that this process results in an effective, well-designed system using appropriate and sustainable technology.

The current system collects data mainly for reporting purposes rather than to prompt specific control actions; however, as Myanmar moves towards a pre-elimination phase in selected states/regions there will be a need to move to village-based reporting. This report lays out a phased approach to upgrading the surveillance system accordingly. For such a system to support reactive, real-time control responses major changes will be required to existing internet and telecommunications infrastructure, which realistically is a medium, rather than a short term, prospect. However, experiences with village-based, day-0 (point-of-care) and day-3 (artemisinin resistance monitoring) surveillance elsewhere in the Mekong region (and notably in Cambodia) are encouraging and in time will become directly applicable in the Myanmar context.

During this consultancy there was a unanimous agreement amongst NMCP staff, NGOs, INGOs and other implementing partners that township health offices represent the natural focus for decentralized data management, analysis and decision-making – and that there is a wider need to empower township medical officers to manage malaria control. Consideration should be given to ensuring that the data assistants are fully integrated into the health system and not considered temporary ‘project’ staff that will disappear when the funding runs out as is presently the case. In addition there needs to be capacity building of government staff at all levels but particularly at township level to analyze and use data. There is also a need to upgrade IT infrastructure and the data management capacity of staff at VBDC and also at township health offices many of which do not have a functioning computer and few of which have effective electronic communications. Investment in these areas is a prerequisite for a good surveillance system and with the expected rapid expansion of mobile coverage in Myanmar it is a good time to start to plan to take advantage of mobile technology and internet to improve the malaria surveillance system going forward.

## 1 Introduction

In recent years the Vector Borne Diseases Control Program (VBDC) has made significant progress in strengthening malaria surveillance in Myanmar. This has involved developing vertical reporting systems for both government health facilities and Village Malaria Volunteers (VHVs) and using both paper-based and electronic methods for compiling and submitting data reports. Under the Myanmar Artemisinin Resistance Containment (MARC) framework, a pilot project is ongoing to test the feasibility of village-specific case-based reporting, which VBDC has set as long-term national goal.

The primary aim of this assessment is to evaluate current approaches to malaria surveillance in Myanmar in consultation with the NMCP and other implementing partners and to provide a set of practical and feasible recommendations to further strengthen the surveillance system in the short to medium term. The assessment focuses on the surveillance of malaria cases (as distinct from more general surveillance to support monitoring and evaluation) and, more specifically, on instruments and systems to collect, collate, report and analyze malaria data as a basis for informing malaria control policy and practice. This report describes the flow (and use) of information from volunteers and government health staff at all levels of the system to the central level and makes a number of detailed recommendations to improve the system and to address some of the bottlenecks and issues identified. The report also includes an assessment of available surveillance data for 2012 and based on this analysis makes recommendations aimed at maximizing the coverage and utility of the existing surveillance system.

The specific objectives for this consultancy were:

1. To conduct a scoping visit to discuss with NMCP staff, partners, and key stakeholders in malaria surveillance in Myanmar and to design a subsequent mission in 2013 to selected, representative townships and state/regional offices.
2. To assess current structures and situation of malaria surveillance system at all relevant levels – particularly with regard to data management and data quality (data collection, reporting systems, data flow, feedback and use).
3. Assess how surveillance data are currently being used to inform management of activities/interventions.
4. To identify potential data gaps in malaria surveillance from public, private, civil societies, etc.
5. To identify current mechanisms of coordination for malaria surveillance and reporting, and propose mechanisms for improvement of collaboration and coordination.
6. To provide recommendations on mid-term/long-term resources and capacity building required (human, infrastructure, systems, technical, etc.).



## 2 Approach and Methodology

The consultants carried out a scoping visit (4-8 February, 2013) during which they worked with VBDC staff in Nay Pyi Taw to review the malaria surveillance system at national level, assess the capacity of VBDC in terms of human resources and infrastructure and select a set of representative sample of townships for subsequent detailed assessment of surveillance activities at various levels of the public health system. During the scoping visit the consultants also met with key staff at SCF and UNOPS to discuss perspectives of NGOs and INGOs who are supporting volunteer-based malaria surveillance as sub-recipients under GF and 3MDG.

The main phase of the assessment was conducted between 28 April to 18 May 2013 and involved carrying out detailed assessments of malaria surveillance activities in three states/regions: Tanintharyi (Dawei township), Mandalay (Patheingyi township) and Rakhine (Thandwe township). In choosing these townships the consultants (with advice from VBDC) tried to include as many different settings as possible; MARC vs non MARC; areas with NGOs vs areas with no NGOs *etc*; while taking into account time constraints and logistical challenges. Originally the consultants were scheduled to visit Sagaing (Kalay township) but in the event this was not possible due to a cyclone and the Mandalay site was chosen as an alternative. Ideally the current assessment would also have included Mon state, where a WHO-developed spreadsheet for village-level case reporting is currently being piloted (one of the consultants has reviewed the malaria surveillance system in two Mon townships as part of a previous mission). Due to time constraints this was not possible and it was instead necessary to rely on a briefing from WHO regarding the status of this pilot test.

In each of the townships visited during this assessment the consultants met with staff at a variety of levels in the surveillance system including staff at state/region and township health offices, township hospitals (TH), station hospitals (SH), rural health centres (RHC), sub-centres (SC) and, where relevant, village health volunteers (VHVs). In Yangon the consultants met with a number of INGOs and NGOs that are actively supporting malaria case management to get their views and suggestions for improving the malaria surveillance system, particularly in relation to communication and integration between partners. A list of all organizations and persons met is included in Annex 1 of this report.

In order to assess the completeness and quality of data collected through the routine surveillance system, data for malaria tests reported by health facilities and VHVs were collated and analyzed (see Section 4). Malaria case data for 2012 were provided by WHO staff, who are currently providing technical support on data management to VBDC.

At the end of the second visit the consultants returned to VBDC for a debriefing and to present initial findings.

During the both visits the consultants were assisted by Dr Tet Toe Tun and Dr Nay Lynn Yin Maung from WHO and Mr Abraham from VBDC (2<sup>nd</sup> visit), who the consultants would like to acknowledge and thank for organizing and facilitating the logistics of the trip and, more importantly, for sharing their insights gained from many years working with the malaria program in Myanmar. Additional thanks go to David Sintasath who was part of the initial scoping visit.

### **3 Malaria surveillance in Myanmar**

#### **3.1 Health management information system (HMIS)**

Up until 2011 data on malaria cases in the public sector (i.e. from hospitals, RHC and SC) were aggregated and reported only through the National Health Management Information System (HMIS). The HMIS consists of two separate systems: the Hospital Health Information System reporting data from hospitals; and the Public Health Information System (PHIS) which handles data from other types of health facility. The flow of data within the PHIS<sup>1</sup> is shown in Figure 1. The hospital information data flow essentially follows a similar pattern with all data ending up with the Department of Health Planning within the MOH.

The data contained within the HMIS is comprehensive and include:

- Monthly reports from all facilities covering IP and OP by disease, births, deaths and activities related to various health programs such as TB, EPI, malaria, sanitation, nutrition and health education.
- Annual reports covering health manpower, basic health infrastructure, information on community participation and vital registration data such as population, births and deaths.

The malaria data within the HMIS are basic and consist of the number of patients tested and the number of positive cases with no species breakdown. The figures reported through the HMIS also do not include cases treated by the private sector or VHVs managed by NMCP, NGOs, INGOs and other implementing partners.

The HMIS clearly does not meet the needs of NMCP for detailed management of malaria but does provide a mechanism for cross checking the total number of cases reported through the HMIS with cases reported through the VBDC malaria reporting system.

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<sup>1</sup> From a presentation "Myanmar Health information System" by Aye Moe Moe Lwin (undated)

## Data flow of Public Health Information System

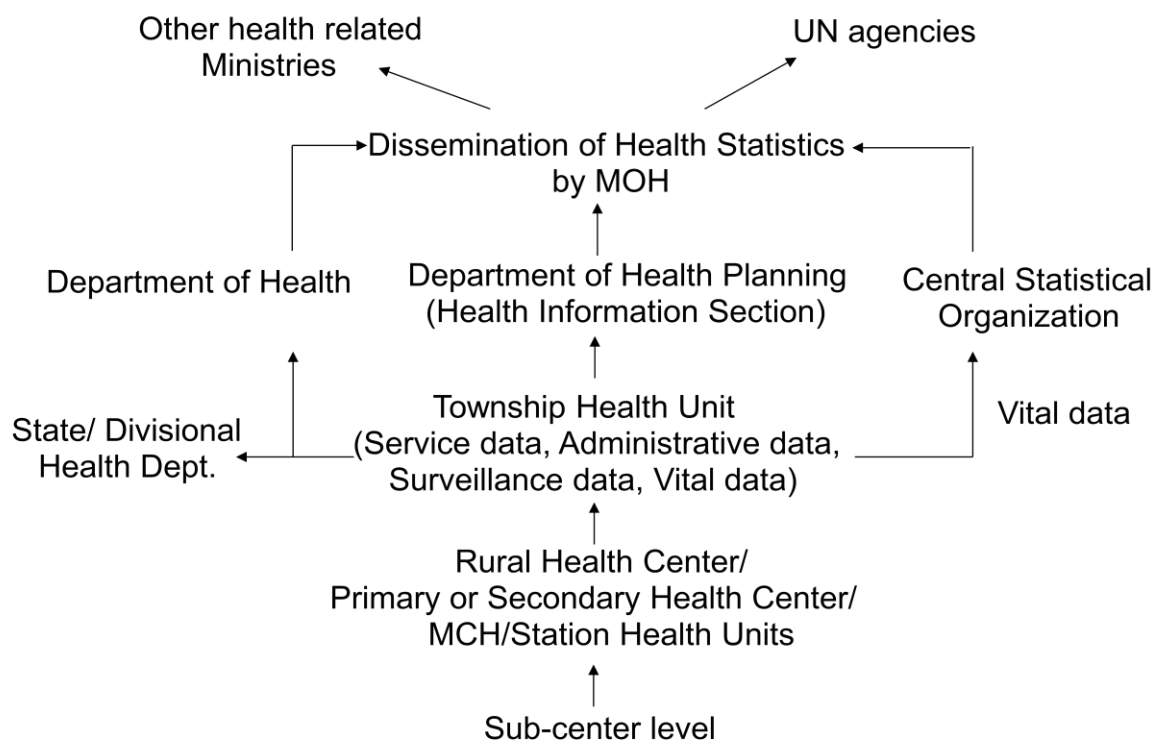


Figure 1. Data flow of the Public Health Information System

### 3.2 VBDC malaria reporting system

Recent estimates put the number of malaria cases in Myanmar between 500,000 (as reported through the public system) and 8 million<sup>2</sup>. The large difference between these lower and upper estimates reflects the generally accepted fact that a substantial (but unknown) proportion of people with fever seek initial treatment from private providers. The traditional view is that relatively few people will present directly to public health facilities (hospitals, RHC and SC), although it is probable that the rapid expansion of the VHV network, which offers free diagnosis and treatment, will alter this picture markedly in the future (see Section 4.2).

Up until 2011 data on the number of individuals tested/positive for malaria in the public sector were aggregated and reported only through the HMIS. In 2011 a new vertical reporting system for data reported by basic health staff (BHS) at government health facilities was introduced through which details of all individual tests (and, where relevant, treatments) are recorded using a newly introduced form. This form also includes data

<sup>2</sup> Strategic Framework for Artemisinin Resistance Containment in Myanmar (MARC) 2011-2015, WHO, April 2011

about drug stocks as well as tally sections that require BHS to stratify the line-listed data by age and village risk stratum.

At that time there was no standard or equivalent reporting system for village health volunteers (VHVs) and no requirement for VHVs to record malaria patients or report to the NMCP. This changed in 2012 when a simplified version of the health facility report form (without the summary sections described above) was designed with the inputs of VBDC, JICA, WHO and implementing NGOs. At present all NGOs and other implementing partners are required to adopt this form and provide reports to the NMCP of all malaria cases they treat though it was noted during this consultancy that this may not yet be the case in practice for all NGOs (see Section 4.2.1).

### **3.2.1 Data flow in the VBDC malaria reporting system**

The current system is designed around a case register (with different versions for BHS and VHVs) comprising four duplicated (“carbonless”) copies that are passed up the chain of supervision and collated at each level up to the central VBDC.

Whilst the system is currently paper based it is recognized that to improve the data management of such a large amount of data and to make more of the data available to more people in a more timely and efficient way, there is a need to computerize the system. This process has begun with the introduction of a system of EXCEL spreadsheets that has been developed specifically to process the case data from the BHS and VHV forms. Data entry and dissemination is managed by data assistants who have been recruited specifically for this task. In most states/divisions a single data assistant is responsible for collating data for all carbonless forms received from townships. In a selected number of high malaria risk states/regions (e.g. Rakhine) two data assistants have been hired because of the relatively high case loads involved. Within areas demarcated as either Tier 1 or Tier 2 under the MARC framework<sup>3</sup> the intention is that each township should have its own data assistant. In the medium-long term the aim of NMCP is to have the equivalent of a data assistant (either as a new post or a role allocated to existing BHS) in all priority townships nationwide.

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<sup>3</sup> WHO/Ministry of Health Myanmar (2011). Strategic Framework for Artemisinin Resistance Containment in Myanmar (MARC) 2011-2015.

**Reporting flow of volunteer and BHS data in VBDC malaria reporting system**

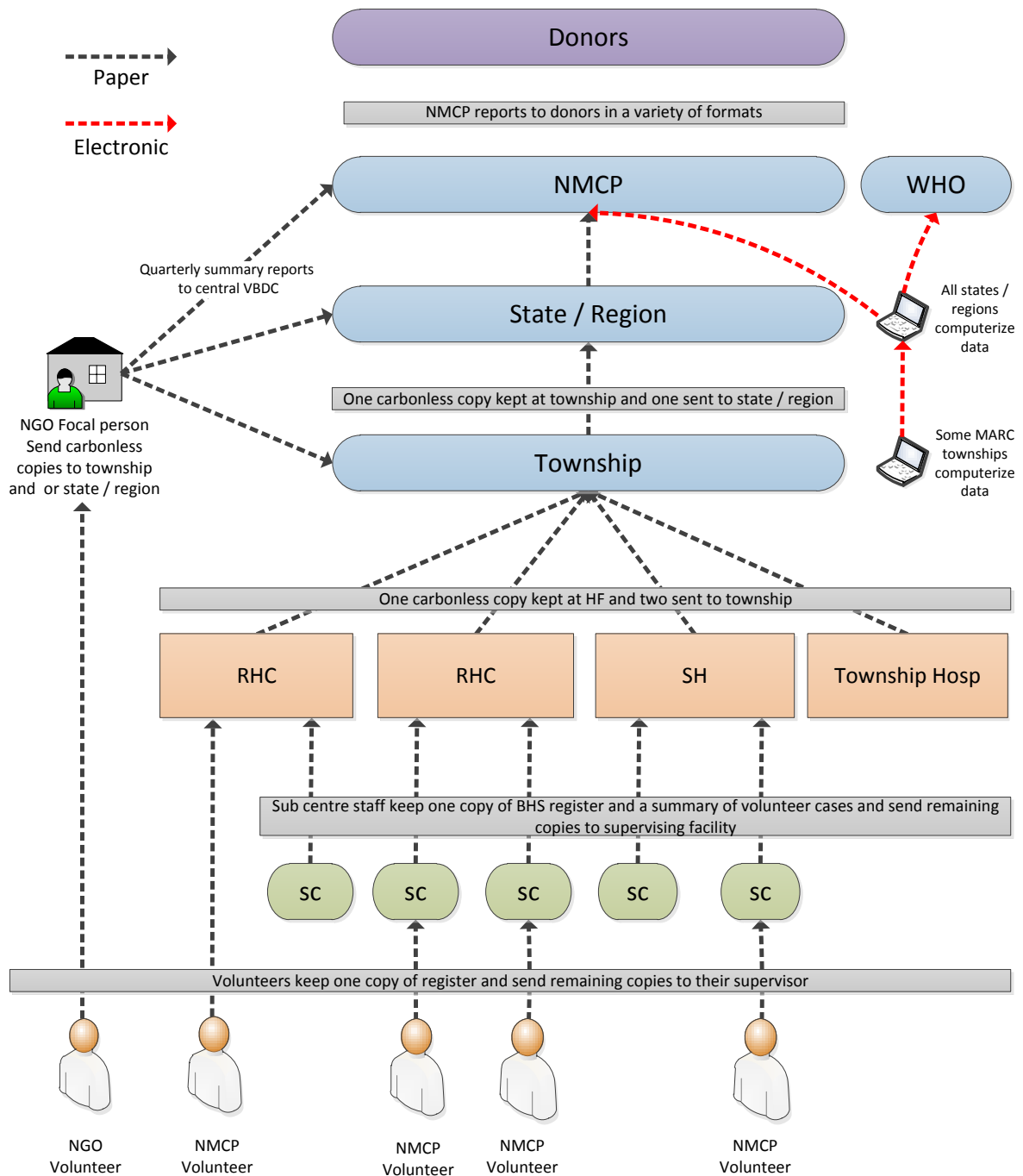


Figure 2. Reporting flow of BHS and VHV data in the VBDC malaria reporting system

**Malaria register**

The case register comes in BHS- and VHV-specific formats and includes a line listing for each malaria test performed (including personal details such as age, sex and details of

treatment), details of stock levels for various malaria drugs and a summary section (BHS form only) in which the person who enters the data is expected to complete their own summary analysis. The data entered for each test are:

Data Item	BHS Form	Volunteer Form
Date of test	X	X
Patient name	X	X
Age group (<1, 1-4, 5-9, 10-14, 15+)	X	X
Pregnant	X	X
Address of patient	X	X
Village stratum	X	
Patient sex	X	X
Microscopy result (negative, Pf, Pv, Mix, Pm/Po)	X	
RDT result (Pf, non PF, Mix, negative)	X	X
Complicated/uncomplicated	X	X
In/out patient	X	
Drugs given	X	X
Treatment < 24hrs, >24hrs	X	X
Referral	X	X
Malaria death	X	X
Implementing partner		X

The consultants consider that the case forms are well designed with the potential to capture all the relevant data required by VBDC staff at all levels. There are some areas that could be improved such as recording the individual's actual age (rather than asking the facility staff to assign an age category, which is more prone to error and provides less precise data for subsequent analysis). Also it would be better to be specific and ask for the patient's village rather than the more vague 'address', especially as the program moves to pre-elimination mode when it is vitally important to know which village the patient is from. In addition currently there is no way of recording whether the individual tested is a migrant.

None of the BHS staff interviewed within the current assessment reported any major problems or issues relating to the forms used for reporting malaria and in all the facilities visited we saw examples of good practice including the daily updating of forms from registers, routine use of zero reporting and a universally high standard of form completeness and legibility. There were some specific comments alluding to the fact that the section on drug stocks was relatively time-consuming to complete; but at the same time all BHS considered this section to be necessary. A small proportion of BHS also reported that they thought it was quite easy for them (or, more frequently, VHVs) to make mistakes when entering information because of the need to enter data in very specific boxes. In terms of overall workload none of the BHS we interviewed considered the malaria report to be onerous (although, considering this is only one of 25 forms they

are required to complete each month, the topic of the overall workload associated with paperwork was raised often).

It is worth noting that the BHS and VHV forms are the product of considerable deliberation and consultation and in light of this it is not recommended to make any changes to the forms at this time. It is important, however, to ensure that appropriate systems are in place to check that forms are filled in correctly. The chances of a referred patient being double counted is not considered very likely as there is a field for referred patients on both forms and it is recommended that these referred patients not be included in the total count. If there is an opportunity in the future to integrate the provision of malaria supplies with other drug supplies this may provide an opportunity to simplify the malaria forms by removing the section on drugs.

### **Basic health staff (BHS) reporting**

All BHS staff at SC, RHC, SH and TH record individual tests (not just positive cases) and drug stock levels and towards the end of the month they keep one sheet and send the rest to the next the health system, which could be a RHC, SH or township health office. The RHC or SH keeps the second copy and passes the remaining two copies up the line of supervision to the township health office, which retains one copy and sends the final copy to the state/region health office.

At the level of RHC and above each level completes a summary data sheet and attaches this to the case register copy. Effectively this means that townships receive a summary of data by facility and that states/regions receive a summary of data by township. At the state/district level a basic summary of cases generated for each township is prepared using a standard sheet and then summarized across all townships. This overall summary is then sent to central VBDC for their national statistics. At present the report sent by the state/region does not include data for volunteers (even NMCP supervised volunteers) as these are included in a separate report.

There are time deadlines at each of the reporting levels which aim to get each month's data to the central VBDC within a month and a half (e.g. by mid-March for January data). But these deadlines can sometimes be difficult to meet due to problems with access, particularly in the wet season, for BHS staff covering remote locations. If townships receive reports late these data will be reported to the state/region as part of the next month's submission and will retain the original date information.

During interviews BHS staff indicated that referrals between health facilities were rare. It was not within the scope of the current assessment to look into this issue directly but moving forward it would be of value to carry out detailed analysis of corresponding datasets at various levels in the health system to determine the true rate of referrals and to gauge whether such instances lead to double counting in the system.



## **Volunteer (VHV) reporting**

VHVs record individual tests and drug stock levels as per the BHS system. VHVs are required to report by a set date each month (usually the 15<sup>th</sup>). They will normally send their data to their supervising midwife at SC level, but there are situations where VHVs report directly to a RHC, SH or the township health office if these are more accessible.

Given that villages are generally allocated volunteers on the basis of the remoteness of their location, the logistics of sending carbonless reports and restocking supplies is often challenging (or, depending on the season, impossible). BHS in Dawei, for example, reported that it was not uncommon for some volunteers to report as much as three months late and as such township staff often need to wait some months before they are in a position to submit their paper summary volunteer reports to the state/region level. By contrast in Mandalay volunteers were expected to operate under the same reporting deadlines as BHS staff and so the figures for volunteers are routinely reported alongside the BHS data. The computerized (spreadsheet) system can handle the late reporting in a more efficient way as the monthly extract that is sent includes all the reports received since the last extract, regardless of the reporting period.

Forms for NGO volunteers are usually sent to the respective NGO malaria focal person who keeps a copy and (in most cases) sends the remaining two copies to either the township or directly to the state/region health office (essentially bypassing SC and RHC levels in the process).

As noted in the Section 4.2.1, at the national level there does appear to be significant gaps in the data available for VHVs in 2012, which obviously needs to be addressed urgently. Much of this missing information is likely to relate to NMCP-supervised VHVs and may well reflect lack of data management capacity at the state/region level rather than gaps in reporting to the township (e.g. the data assistant post for Chin is currently vacant, which might explain the absence of available VHV data for that state). At the same time, however, there appear to be no guidelines for NGOs as to whether they need to report to the NCMP and if so whether the carbonless copies are to be sent to the township or state/region office. In practice NGOs decide that for themselves based upon logistics and other factors and this can mean that township health offices can in some instances have no data on malaria caseloads for some villages within their catchments.

### ***Recommendation***

***All NGOs, INGOs and other implementing partners that support VHVs should use the government system of carbonless case registers. In addition to any requirements from the partners to provide the central VBDC with periodic summary reports, copies of VHV carbonless sheets should be sent to the relevant township health office.***



For NMCP supervised volunteers the midwives at SCs normally keep their own summary and pass the three remaining copies to their supervising RHC or SH. The RHC and SH keep the second copy and pass the remaining two copies up the line of supervision to the township which keeps one copy and sends the final copy to the state/region. At the level of RHC and above each level fills in a summary and attaches this summary to the case register copy as described for the BHS system.

As 2013 is the first full year with the standardized VHV case register there are no clear guidelines for the paper reporting flow for VHV by the states/regions and they appear to devise their own aggregated reports to send to central VBDC on volunteer activities. As previously mentioned, Dawei reports the VHV data separately from BHS data but in Mandalay it appears that VHV data are routinely integrated into the normal BHS reporting process and the township aggregates the data from the volunteers and reports them alongside the health facility data. This anomaly results in confusion at national level as to whether data for individual state/regions include information from volunteers or not.

### ***Recommendation***

***Central VBDC should issue clear guidance to states/regions and townships specifying how VHV data should be compiled and reported. This report recommends that the system used in Mandalay (whereby the VHV data are compiled and reported alongside BHS data and within the same timeframe) is the most appropriate model.***

For NGO supported VHVs, supervising NGOs are required to summarize their volunteer data on a quarterly basis and send to central VBDC in a standard format. However, it appears that the central VBDC have some problems with these reports not conforming to the required format.

### ***Recommendation***

***Central VBDC should issue clear guidance to NGOs and other implementing partners regarding the format of the quarterly summary report they are required to submit. To improve the data management of these data it would be sensible to provide a soft copy template in EXCEL to make combining the data more straightforward.***

During this assessment it was possible to interview VHVs and/or their supervising midwives (although given the size and wide distribution of the current VHV network this was admittedly a small sample). A common issue that came up during our discussions was the impact of poor geographical access on the ability of VHVs to report on time. As noted earlier in some instances it was common for VHVs to combine reports for two or three months at a time, although none of the SC/RHC staff we interviewed thought that overall reporting completeness was a major problem. Unfortunately there does not

appear to be a routine system for logging reports in and out (at any level in the system), so there is no formal way for BHS to keep a track of the status of VHV reporting on a village by village basis (see Section 4 for more discussion on this and relevant recommendation).

Despite these constraints it appeared that the VHV system was operating effectively at the relevant SC/RHCs visited during this assessment. We witnessed a number of very positive elements in the system: the fact that VHVs routinely complete (and submit) a zero report when no individuals have been tested; high levels of support and feedback from supervising midwives (including checking of reports when received); and a high standard of general record keeping.

At the national and state/region level, however, some concerns were raised about the effectiveness and sustainability of VHVs, particularly within the NMCP system where currently there is no use of financial compensation or incentives. As discussed further in Section 4, it is generally assumed that among VHVs who have been trained perhaps 70-80% will be active; however, because no system currently exists for routinely tracking VHV submissions there is no way of knowing whether this is actually the case. Staff at central and state/regional level consider lack of financial motivation to be major factor in what appear to be high levels of attrition and under GF Phase 2 there are plans to provide financial support to NMCP-supervised VHVs in the form of a K20,000 (~US\$20) quarterly payment plus travel reimbursement for reporting.

Nearly all of the NGOs met as part of this assessment have been providing their own VHVs with financial support of one kind or another for some time. Payment structures vary considerably; some NGOs pay VHVs a set monthly sum, while others pay on a per test basis (while others do both). Some also incorporate more novel elements such as prizes related to performance. Whatever payment system is used, VHV data available for 2012 do appear to indicate that providing incentives are an effective way of encouraging volunteers to detect more cases (see Section 4.2.3). Feedback from NGOs also suggests it encourages VHVs to remain in service for longer and, because provision of payment fundamentally changes a VHV's terms of service, it also makes it possible to stipulate certain contractual obligations that can improve system continuity (e.g. some NGOs require formal notice of one month in advance of a VHV standing down). In other instances it has provided a basis for defining rules that determine at what point a volunteer becomes officially inactive (under UNOPS, for example a VHV is defined as inactive once two consecutive reports have been missed). These details become critically important once any system of incentives is introduced and should be considered carefully by NMCP in advance of GF Phase 2. However, NMCP should also consider the potential effect of providing financial support to VHVs on other cadres of staff in the health system. This is particularly the case for midwives who appear to have very demanding roles and to be remarkably motivated despite relatively low salaries. We came across one instance where midwives were taking on some volunteer responsibilities by visiting VHV villages to collect data forms (and using their own

motorcycles and fuel in the process). It is important to avoid a situation where BHS staff become effectively de-motivated in an effort to motivate the volunteers they supervise.

The wide variety of different compensation/incentive structures for VHVs under different NGOs suggests that there might not be a suitable "one-size-fits-all" solution that is applicable across the country. For example, where caseloads are low, payment per test will be less popular than a fixed monthly payment (while in areas with high caseloads the opposite will be true). Given the wide variation in different type of compensation/incentivization provided to VHVs a formal evaluation of these different approaches and their potential effect on volunteer performance (e.g. reporting completeness and timeliness, blood examination rates, appropriateness of treatment, use of DOT) would be valuable. It would be beneficial if, as part of this process, any large differences between the scale and nature of support between NMCP- and NGO-supervised VHVs (and indeed between NGOs) could be minimized.

In our discussions with NGO representatives it is clear that there are a large number of examples of good/novel practice that should be documented and used as a basis for future guidelines on VHV management. One NGO, for example, described a semi-formal system in which incoming VHV data were used to periodically review (and, if required, adjust) the number and distribution of volunteer villages under their supervision. (Ultimately township health offices should have a similar capacity). Another NGO described how VHV data were used to assess whether there was a need to introduce active case detection in selected localities. In terms of VHV management and motivation NGOs stressed the importance of coordination meetings, meaningful feedback and opportunities for volunteers and others to share their experiences. One NGO actively used a peer system in which under-performing volunteers were matched up with strong performers.

***Recommendation:***

***Although there is good evidence to suggest that the introduction of financial compensation for NMCP-supervised volunteers will reduce attrition and improve service quality this move should be informed by both previous NGO experience and an assessment of possible wider effects on the health system.***

***An evaluation of VHV performance across the full range of partners operating in Myanmar should be carried out and should include an assessment of various motivational factors. Such an evaluation should also seek to document examples of best-practice in VHV management and coordination.***

### **3.2.2 Data management tools**

At present the NMCP primarily uses the paper based system to generate most of their reports and statistics as it is standard across the country and works in a reasonable time

frame considering the sometimes difficult local conditions. However, this paper based system aggregates the data as they travel up the chain of supervision, so in practice much of the detail from all of the individual test data is lost.

In an effort to improve the data management and use the detailed information contained in the case registers, spreadsheets were introduced to enable the individual test data to be entered as well as the drug usage data and some general information such as the total numbers of inpatients and outpatients. There are separate spreadsheets for BHS and VHV reporting, each with a sheet (i.e. individual tab) for the line listing of malaria tests and a sheet for drug stock management. In addition there are many additional sheets (20+) containing summary data (via pivot tables) for analysis and management. There is one notable data item that is not entered into the EXCEL spreadsheet and that is the village name of the patients. There are practical reasons for this at this stage (primarily the lack of standardized village lists with a proper coding system), but this report feels that this somewhat negates the very reason to computerize the case listing and should be addressed.

There was a small trial of an enhanced EXCEL sheet in two townships in Mon state where the data assistant was supposed to maintain a village list and enter the patient village but this was not successful as it was introduced in such a way as to require the data assistant to do this in addition to the BHS and VHV spreadsheets. It was also introduced at the same time as the roll out of the spreadsheet system, recruitment and training of data assistants and as such there was a lack of technical support. In hindsight a better approach would have been to concentrate on the basic system first and to introduce village level reporting systematically to townships once the core system was demonstrated to be running well with data assistants recruited and trained and with well tested data management procedures and tools in place.

At present there are two data assistants in each of the three states/regions with the highest number of malaria cases (Rakhine, Kachin and Sagaing). The remaining states/regions each have one data assistant, although vacancies in at least two of these were noted. In the MARC townships the aim is to decentralize the data entry to township level and data assistants are being hired for this purpose. Where data are entered at township level the spreadsheets are sent on to the state/region data assistants (using CDs) who then combine the data from multiple townships into a single state/region spreadsheet. Datasets for each state/region are then sent simultaneously to WHO and central VBDC. If there are no township data assistants the state/region data assistants enter all the data before sending the spreadsheets to WHO and central VBDC.

Nationally, the amount of data being generated by this case-based reporting system is very large. As described in Section 4, details of over a million malaria tests carried out by BHS and VHV's (plus information on associated treatments) were entered into the spreadsheet system in 2012. It is evident from our interviews with data assistants at township and state/regional level, however, that the present setup using EXCEL is not

well suited for purposes of data entry or data dissemination. For individual states/regions the spreadsheets can become very large (sometimes over 200 Mb) and these not only take a long time to open (sometimes up to five minutes, mainly because of the pivot tables), but are also difficult to manipulate. In practice data assistants have to manually copy and paste raw data from the master spreadsheets into new spreadsheets in order to end up with file of a suitable size for sending to the higher level. Even these 'smaller' data-only spreadsheets can be relatively large. In the case of Tanintharyi a single month's data typically equated to file of about 15 Mb. This could be reduced to ~4 Mb after compression but even a file of this size could take a day or more to send from an internet shop (due to numerous drop-outs whilst trying to email). In addition to the effort required to do all of this manipulation the data assistants usually have to use their own funds to pay for the email.

At the end of the process all of these spreadsheets (one BHS and one VHV file (where relevant) per state/region per month) have to be manually combined at the national level. In practice and because of the size of these sheets they are kept as separate files for each state/region by year and source (BHS/VHV). The result of this is for one year's data at national level there are around separate and very large spreadsheets. Needless to say it is very difficult and time consuming to manipulate these spreadsheets to produce the standard reports required by the NMCP and to respond to *ad hoc* requests for data or analytical queries from donors and other stakeholders.

In terms of data quality checks it is hard for EXCEL to capture potential errors during data entry, to allow for zero reporting from VHV's and easily see which reports are still outstanding from both the health facilities and volunteers. As discussed in Section 4, as the VHV system continues to expand and to account for an increasing proportion of cases detected nationally, the need for a system to routinely track VHV reporting rates becomes increasingly important. Without this basic information national estimates for key metrics including annual parasite incidence and blood examination rate will become unreliable.

During the current assessment the consultants were very impressed by the effort and commitment shown by the data assistants at all levels and the data management staff at WHO and NMCP to make the EXCEL system work. However, it is clearly apparent that the volume of data is too large for the current system to handle and that this has major ramifications in terms of data usability and timeliness<sup>4</sup>. One consequence is that in practice the NMCP still routinely relies on the paper system for producing reports and compiling summary data outputs.

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<sup>4</sup> Currently the paper and electronic components constitute a "two-speed" system with malaria focal persons at township and state/regional health offices being able to summarise and send on their paper-based reports much more quickly than data assistants operating at these levels are able to process the data. For this reason all levels of the system appear to chiefly rely on their paper records for official reporting purposes.

Because of the evident limitations in using EXCEL to provide the kind of sophisticated level of data management now required in Myanmar, the consultants believe strongly that NMCP should consider switching to an ACCESS database to manage these data (see below for a more detailed rationale for this and a suggested database design). In fact NMCP has for some time recognized that a switch from spreadsheets to a relational database would be necessary at some point the future, especially given the medium term aim to incorporate village level reporting. However, given the very obvious problems with the current EXCEL system this move should be made as soon as possible.

In the short term this database would just replace the functionality of the existing EXCEL spreadsheets and its introduction would therefore require minimal additional training of the data assistants. The system should be introduced in a phased manner (systematically by state/region) and be designed in such a way that, during the interim period when both EXCEL and ACCESS systems are operating in different states/regions at the same time, data from both systems are compatible and can be easily combined at national level.

The database should also have a village level module that will allow (at some future date) the management of the township village lists to enable the entry of the patient village (in the BHS system) and allow for the village level reporting and analysis which is widely accepted to be a necessary level of surveillance when moving to a pre-elimination phase.

The database should also include the ITN/LLIN distributions that are currently reported by paper from township to state/region and central level. Presently these data are summarized by village stratum but when the townships switch to village level reporting it will be possible to monitor these data at village level.

### **Recommendations**

***An ACCESS database should be developed for national level, states/regions and townships to manage the large amount of data currently being processed by the EXCEL spreadsheets. In the short term the database should be designed to directly replace the existing spreadsheet functionality (plus ITN/LLIN distribution data). However the system should be designed to include a module for entering and managing village-level data using standard look-up lists developed and managed at township level. The “village module” should remain de-activated until townships are in a position to move, in a phased approach, to true village-based reporting over time with a minimum of disruption.***

Some of the practical and immediate benefits to changing to a database to replace the EXCEL sheets include:



- Use of a single database with separate data entry screens for BHS, VHV data, LLIN and drug data
- Substantial reduction in the number of keystrokes required for data entry
- Capacity to include “zero” reports for BHS and VHV data
- The ability to routinely and efficiently track completeness of reporting by health facilities and volunteers
- Built in error checking
- Generation of (much) smaller files for dissemination to higher level
- Automated collation of data at higher level
- Automatic production of all required NMCP and donor reports, graphs and export of data to various alternative formats for further manipulation
- Automatic mapping of malaria by township using Google Earth or GIS software
- Much reduced need for data management/manipulation with corresponding reduction in chance of errors
- Enhance the ability of township and state level staff to analyze their own data and provide feedback to lower levels

In addition, and as required, the database could later be used for:

- Management of village lists to allow for village level management and mapping of malaria data
- Management of VHVs
- Management of health facilities and the villages they supervise

### **3.2.3 Management and coordination**

During this consultancy there was a unanimous agreement amongst NMCP staff at all levels as well as NGOs, INGOs and other implementing partners that township health offices represent the natural focus for decentralized data management, analysis and decision-making – and that there is a wider need to empower township medical officers to manage malaria control<sup>5</sup>. There are many justifications for this: township staff know all the villages and health facilities in their area; are the main responders to outbreaks<sup>6</sup>; and are responsible for health education activities and ITN distribution and re-treatment. It was noted that one of the many duties of the midwives included a yearly head count of all the village populations by age group. The consultants feel that it would be a relatively easy exercise to generate a village list and annual populations for each township from

<sup>5</sup> Within the Ministry of Health document "Monitoring-evaluation plan malaria prevention and control Union of Myanmar 2010-2015" an explicit target is for 180 priority townships to be capable of “planning, implementing, monitoring and evaluating malaria prevention and control programme with management and technical support from higher levels”.

<sup>6</sup> It appears that written epidemic detection and response guidelines are available (in Burmese) and set out clearly roles and responsibilities for outbreak investigation and response. The township is responsible for coordinating response activities with specialist input from the state/region and VBDC (e.g. for microscopy or entomological support).

the midwives records which could be used by the proposed database to move to a more useful village based reporting system.

The township level is also the natural level for the decentralization of data management. As noted previously, within the MARC program data assistants are being recruited for all townships in Tier 1 and 2 areas – but it is also the aim of VBDC to have an equivalent post in all townships in the medium term. As such there is a need to develop the capacity of the township staff in all areas of data management and general computer literacy. Ideally this scenario in the long term will involve use of existing government staff members at the township office to carry out this data management role, rather than the current (and arguably unsustainable) system of depending on project-funded posts. All Township Medical Officers we interviewed felt that there was sufficient capacity within current staffing arrangements to facilitate such a system – and many felt that developing the necessary data management capacity would have wider benefits within the township health office.

At present the management of data at national level is a collaboration of NMCP and WHO staff (who work on short term contracts funded by 3MDG and GF) but over time it should be expected that NCMP will assume responsibility for all of this work. However it is clear that there is a need to develop the capacity (both HR and infrastructure) at the central level to manage this large amount of data and probably a need for some longer term TA to assist the national program and partners through the process of developing, implementing and trouble-shooting the new system. Myanmar has many of the characteristics of the situation in Cambodia before the Containment Project but faces much bigger challenges; namely significantly more malaria cases, a more challenging geography, accessibility, a large number of implementing partners and poor telecommunications and other infrastructures.

As part of the Containment Project in Cambodia considerable TA was provided to the national program in the area of surveillance and data management, including two full-time international staff positions (Data Manager and Epidemiologist), one local staff position (Data Manager) and various short-term specialists provided through Malaria Consortium as well as various WHO consultants. Without this level of TA it is doubtful that the national program could have developed a case-based system to handle ~100,000 malaria annual confirmed cases, and this suggests that substantial TA may be required to set up a robust and sustainable system to manage the 500,000+ annual cases in Myanmar.

### ***Recommendation***

***Long term technical assistance (TA) should be considered in the area of surveillance and data management to support the NMCP and partners to coordinate the development and implementation of the malaria case-based reporting system; the phased introduction of village level reporting at township***



***level and strengthening of the capacity of NMCP staff to manage the data, particularly at township and central level.***

There is not a well defined mechanism for feedback of data back down the reporting chain although there are monthly meetings at township level for BHS (and sometimes including NGOs) where malaria data can be discussed. There are also *ad hoc* national workshops where states/regions can present and discuss their malaria situation and national reports are produced by nationally and by the states/regions.

### **3.2.4 Infrastructure and staff capacity**

Many township health offices (and some state/regional health offices) are lucky if they even have one functioning computer and few have effective electronic communications. Data assistants are issued with a laptop but there is often no alternative computer that could be used if the laptop breaks down and sometimes there are lengthy periods where the office is without electricity. Given the climate and variable quality of the electricity supply it can be expected that the lifespan of the laptops provided to data assistants will be short and there was some evidence of this already with some of the laptops already suffering minor malfunctions.

#### ***Recommendation***

***For state/region or township offices there should be a backup plan for the breakdown of data assistant computers. Ideally townships should also have a general desktop computer that can also be used by the data assistant as necessary.***

None of the health offices visited during this assessment had email or internet access, although individual data assistants did use their own funds to email the EXCEL spreadsheets to the higher levels either by using internet shops or their own mobile phones. It was explained to the consultants that there are possibilities for the data assistants to claim expenses but the procedures are too complicated and so none of the data assistants interviewed had been able to get these costs reimbursed.

Staff capacity and motivation appeared very high at all levels including VHVs, BHS and data assistants. Whilst some BHS staff complained about the time it takes to complete the malaria reporting forms (one of approximately 25 forms they have to complete every month), none of the volunteers or BHS staff had any trouble understanding the forms and the quality of the form filling appeared to be excellent. The capacity of the central level staff is high but there does not appear to be much emphasis on the data management aspects and they rely to a large extent on the technical support of WHO which is highly dependent on donor funding (3MDG fund a position in Yangon and GF fund a position in Nay Pyi Taw).

The IT infrastructure at central VBDC is better than in the states/regions, but is still inadequate. There are computers but no network, email or internet. There is no central

server and as such there are no automated backup procedures and it is difficult for staff to share data.

### **Recommendations**

***The IT infrastructure at central VBDC needs upgrading with a network, server and procedures for sharing and backing up data. Email and internet access is essential for the states and townships to email their monthly updates and other reports.***

### **3.3 Alert system for notifiable diseases**

A necessary part of a good disease surveillance system is the capacity of health staff to identify unusual outbreaks of diseases such as malaria or dengue or instances of diseases such as typhoid or cholera which need to be immediately reported to the appropriate staff for immediate action. The general HMIS is not responsive enough for this and in most Mekong countries there is some sort of alert system in place for this task. Myanmar is no different in this respect and has a system in place to report on selected diseases on a weekly basis and guidelines that require reporting cases of certain diseases (such as dengue) as soon as a case is identified. What appears to be a little different in Myanmar is that the notifiable diseases are not the same in each state/region and there appears to be some flexibility in how the system is used. In Dawei township there is a system that requires all dengue cases to be reported by phone and a register of individual cases was observed at the regional health office. BHS staff in Dawei are also required to report malaria outbreaks by phone but there was no clear guidelines as to what constituted an outbreak and nobody could remember the last time there was such an outbreak citing the already low (and reducing) number of malaria cases. In Thandwe there are fewer dengue cases and these cases are not required to be reported by phone but the BHS staff send each suspected case to the district hospital. A notifiable disease form was observed which requires a weekly report of a number of diseases such as AFP, NNT, Measles and deaths of wild and domestic birds. This report is to be completed whether or not there are any cases. All midwives interviewed indicated that they would report by phone any outbreaks of malaria above the normal but all again said they could not remember the last outbreak as the numbers of cases were low and reducing.

Whilst this alert mechanism is not really relevant to the malaria surveillance system at this time when the number of cases are so low as to not require a separate vertical malaria reporting system this alert mechanism could be used to rapidly identify and respond to individual malaria cases.

## 4 The 2012 malaria surveillance dataset

### 4.1 Overview of available data

In order to access the completeness and quality of routine malaria surveillance data, case data reported by BHS and VHVs were collated and analyzed. These data included all BHS and VHV case data received by WHO/NMCP up to the beginning of May 2013. As such it should be emphasized that this does not constitute the final, definitive dataset for the year 2012 and the description of the data that follows should therefore be seen as indicative only.

The data supplied by WHO consisted of the individual BHS and VHV spreadsheets compiled by data assistants at each state/region (see Section 3.2.2). For the current assessment, these spreadsheets were collated to produce a single national dataset for all data sources and only a limited amount of data cleaning was carried out. It is worth reiterating here that this compilation process was time consuming and that the existing system of EXCEL spreadsheets is not well suited to performing queries that require data from more than one state/region. In future a single national database will make these queries much more efficient to perform.

The current compiled dataset for 2012 includes records for 1,036,599 individuals tested for malaria, of which 369,122 (35.6%) tested positive for malaria parasites.

Table 1. The number of individuals tested, positive and negative for malaria in 2012, by data source

Data source							
Status	BHS		VHV		Screening points		Total
Examined	808,050	(78.0%)	213,731	(20.6%)	14,818	(1.4%)	1,036,599 (100%)
Negative	481,255	(72.1%)	173,843	(26.0%)	12,379	(1.9%)	667,477 (100%)
Positive	326,795	(88.5%)	39,888	(10.8%)	2,439	(0.7%)	369,122 (100%)

Table 1 indicates that, overall, 78% of individuals tested for malaria presented at health facilities and 21% were tested by VHVs<sup>7</sup>. The proportion of tests carried out by VHVs increased over the course of the year (from 9.4% in January to 30% in December) and also varied substantially by state/region. In Mon, Thanitharyi and Kayin, for example, the proportion of malaria tests carried out by VHVs was 65%, 55% and 43% respectively. For states/regions lying outside MARC Tiers 1 and 2 this proportion was typically in the range 1-5%. Notably, although VHVs were responsible for more than 20% of tests

<sup>7</sup> Additionally a small proportion (1.4%) of tests were carried out at screening points. The 2012 compilation includes 14,818 individuals tested at screening points in Bago East (1 township, number tested=6,993), Mon (4 townships, n=4,375) and Tanintharyi (3 townships, n=1,011). The proportion of individuals testing positive for malaria varied substantially between the three states/regions (at 11%, 18% and 38% respectively).

carried out they accounted for a substantially smaller proportion (10.8%; Table 1) of confirmed malaria cases (see discussion on test positivity rate below).

Almost all of the records in the 2012 compilation were confirmed by RDT or microscopy and only 1,239 (0.1% of the total records) appeared to be unconfirmed. Overall, 91% of tests were carried out using a RDT. As expected, the ratio between confirmation by RDT and microscopy varied depending on facility type (see Table A1 in the Annex 2). But notably even at township hospitals most diagnoses were carried out using a RDT.

## **4.2 Surveillance coverage and data completeness**

There are a number of elements to consider in gauging reporting coverage and completeness. Firstly, there is the question of the geographical “reach” of the surveillance system and the extent to which it is able to cover all communities potentially at risk of malaria. Secondly it is important to determine the extent to which potential malaria cases in areas covered by surveillance are actually tested for infection. Thirdly, it is also important to be able to determine the completeness of data reporting from individual health facilities or volunteers supported by various partners.

### **4.2.1 Assessing reporting rates and the significance of “zero” reports**

On the evidence of our field visits it appears that it is standard practice for both BHS and VHVs to submit zero (or “nil”) reports for months in which no malaria tests were carried out. Unfortunately in the current EXCEL based data entry system there is no mechanism for incorporating information about these zero reports and as a consequence it is not possible to determine whether the absence of data for a health facility or VHV village in any given month is due to (a) a true absence of tests carried out; or (b) a lack of reporting. It is therefore vital that any future data management system includes information on zero reports, as without this information there is no way to track completeness of reporting (or generate accurate incidence estimates, see below). The implication in the short term is that it is very difficult to gauge reporting completeness without an extensive audit of data submitted to individual townships.

An additional problem associated with the current spreadsheet system is that standardized look-up lists are not used to enter health facility names, which means that reports for a single facility might be entered under several different name variants. In the 2012 BHS data there are 2,762 unique health facility names. After a first cut of data cleaning this was reduced to 2,213 - but given that in 2012 the total number of BHS reports received each month ranged between 1517 and 1725 (mean=1626) it is clear that these data still include a large number of duplicate facilities.

A very rough indication of reporting completeness can be obtained by examining the monthly breakdown of reporting for health facilities with relatively high caseloads (i.e. facilities which would be expected to carry out at least one malaria test per month).

Taking all health facilities together, the median number of people tested for malaria per facility over the course of 2012 was 178 and the 75% percentile was 467. Given that the “top” 25% of facilities therefore tested well in excess of one patient per day on average, it would be unusual for any of these facilities to report no tests in any given month. If for these facilities (n=555) we assume that an absence of data for any given month is indicative of a failure to report, the overall reporting completeness for this subset of facilities is 74%<sup>8</sup>. Of these 555 “top” facilities 69% submitted 12 monthly reports in 2012 and 88% were missing two reports or fewer. It may well be the case that data for these “missing” months are being included under the returns of other months (in which case reporting is technically complete, even if this provides an inaccurate picture of seasonality of transmission) and visual inspection of data for these facilities certainly suggests that this is often the case. However, it is also evident from inspection of disaggregated reporting rates that data are likely to be incomplete for some states/regions for certain months (and not just towards the year end, which is to be expected).

It should be reiterated that this is a somewhat rough-and-ready and imprecise approach to assessing reporting completeness in the BHS dataset. The results of this exercise do, however, point to potential problems with reporting rates in some states/regions and it is recommended that a more rigorous, systematic analysis of reporting completeness is undertaken to verify this. Most urgently, new monitoring systems need to be introduced to enable township and state/region health offices to record and track individual reports as they are received and sent out. Additionally, future data entry systems should be capable of dealing with zero reports (cf. Section 3.2.2).

Moving forward it will be essential to also capture information on zero and/or missing returns from VHVs, as currently there is no way of monitoring which VHVs are active and which are not (NMCP and UNOPS both assume that at any one time 70-80% of VHVs will be active – but as things stand it is difficult to verify this). Determining the number and/or proportion of VHVs that are currently reporting is hampered not only by this lack of data on zero reports, but also (as with the BHS data) by the absence of standard look-up lists for volunteer and VHV village names, which means that many name variants will be present in the compiled data<sup>9</sup>. In 2012 the number of VHV villages reporting malaria tests increased from 527 in January to 1,536 in October, reflecting either a scale-up in the VHV network or progressively improved integration of VHV data from partners (or both). As with the BHS data these numbers relate to the total number of villages

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<sup>8</sup> Note, however, that this metric varied substantially between states/regions. Three states/regions appeared to have overall reporting rates of less than 60% in 2012 (Ayeyarwady, Kachin and Chin) but eight had reporting rates of over 80% (Bago East and West, Kayin, Mon, Rakhine, Shan North and South and Tanintharyi).

<sup>9</sup> In the 2012 VHV dataset there are fields for both volunteer name and volunteer village name. Both fields appear to be largely complete but, as with the BHS data, single names often have a variety of different spellings. In the VHV compilation there are 3,321 unique VHV village names but the maximum number of villages reporting malaria tests in any given month was never more than half of this figure.

reporting at least one malaria test in a given month; villages for which reports were submitted, but for which no tests were carried out, are not included. Because there is no way of knowing how many zero reports were submitted it is not possible to estimate the completeness of reporting for VHVs.

Despite this limitation it is evident that the number of VHVs reports included in the 2012 dataset is far lower than would be expected based on estimates of the number of VHVs trained in recent years. The total number of currently active VHVs is, in reality, difficult to estimate precisely because of the large number of implementing partners funded through GF and 3MDG (currently there are at least 13 NGOs or INGOs supporting VHVs in addition to NMCP) and a lack of reliable data on attrition rates. At the end of 2011 it was estimated that 9,387 VHVs had been trained in the previous two years, of which 6,100 were managed by NMCP<sup>10</sup>. More recent data provided by SCF, UNOPS and NMCP indicate that a total of 10,531<sup>11</sup> VHVs had been trained by the end of 2012, of which about 5,560 were under NMCP<sup>12</sup>. As already noted, not all of the volunteers who have received training are expected to be active and not all volunteers who are active will be responsible for case management. However, even taking these factors into account it does appear that VHV data are significantly under-represented in the current 2012 data compilation.

A map showing the geographical distribution of VHV villages in 2012, presented as the total number of VHV villages reporting malaria tests per township, is presented in Annex 2 (Figure A1). This shows a good representation of VHVs within MARC Tier 1 townships (78% of all VMW records in the 2012 compilation come from Tier 1). At this stage it is not possible to provide a regional/state breakdown of the number of VHV reports received versus the number expected based on the numbers of VHVs trained - but it seems likely that completeness of VHV data in the 2012 data varies across the country. A short-term priority, therefore is to establish an accurate register of trained VHVs with case management responsibilities. This list should be maintained by NMCP, with NGOs and INGOs providing regular updates through their respective PRs, SRs or funding agencies. In the medium term there will be a need to move towards integration of information on volunteer activities at village level within the malaria database - this would allow a rigorous (and dynamic) assessment of coverage of VHVs in relation to high malaria risk villages and/or villages with relatively poor geographical access to existing curative services.

It is worth reiterating that, despite what are probably substantial data gaps in the VHV dataset, in 2012 VHVs still accounted for 21% of all malaria tests and 11% of malaria cases diagnosed. The true proportion of cases being diagnosed by VHVs is probably substantially higher than the current data suggest. Moreover, given the ongoing

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<sup>10</sup> Schapira A (2012) Analysis of gaps related to the national response to malaria and recommendations to the 3MDG Fund. UNOPS/3MDG Fund.

<sup>11</sup> Note, this figure does not include around 1,200 Sun Primary Health Providers supported by PSI

<sup>12</sup> It is worth noting that this estimate differs substantially from NMCP's own estimate of 3,875 VHVs.



expansion of the VHV network, the proportion of total tests being carried out by VHVs is set to rise further. Given this scenario there is a vital and urgent need to determine with much greater accuracy (a) the true number of active volunteers and their distribution by township; and (b) the reporting completeness of individual VHVs on a monthly basis.

On a related point, although the 2012 data compilation includes some data from screening points, it is not possible to gauge whether or not data from mobile clinics are currently included. Anecdotal evidence from NGOs suggests that no standard system for reporting the data exists. In Dawei the regional data assistant included any mobile clinic data she received within electronic returns for VHVs – but it is not clear if this is always the case elsewhere. The advantage of a relational database will be that different data entry screens can be developed for different data sources (BHS, VHV, “backpack” VHVs, screening points, mobile clinics and other testing points that may be developed in the future) and these data can then be disaggregated at the point of analysis.

#### **4.2.2 Annual blood examination rate (ABER)**

The ABER is the number of parasitological tests carried out per 100 persons per year and is a standard indicator of the adequacy of case detection. For 2012 the overall ABER for Myanmar was 2.54<sup>13</sup>. There is no real consensus on appropriate targets for the ABER, which in any case will depend on expected incidence rates and the extent to which testing is guided by presence of fever. However, during the Global Malaria Eradication Programme, API estimates were only deemed to be valid if the ABER exceeded 10%. Moreover, during an elimination phase the ABER would be expected to be much higher than this threshold (in the period 2007-2011, for example, the ABER in Malaysia was around 50%). Based on data reported to WHO for 2011<sup>14</sup> the ABER for Myanmar is similar to that of Cambodia and is somewhat below that of Thailand (currently 4%, although the ABER in Thailand has been falling steadily since 2000, when it was around 12%). It is also substantially less than corresponding estimates of ABER for Lao PDR (8%) and Vietnam (9%).

It should be recognized that national estimates of ABER may in some cases be misleading not least because the population denominator used in its calculation can be difficult to estimate or used inappropriately. National figures may also mask considerable variations in ABER at sub-national level. In the case of Myanmar, Figure 3 indicates not only substantial inter-state/region variation in ABER, but also a strong positive correlation between ABER and malaria incidence, which is encouraging. This means that states/regions with relatively high malaria incidence also have higher ABERs, typically in the 5-10 range.

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<sup>13</sup> Note the denominator used in this instance is total population of townships reporting malaria test data (i.e. not total national population, use of which would result in an even lower estimate of ABER).

<sup>14</sup> WHO (2012) World malaria report 2012. Geneva: World Health Organization. Available: [http://www.who.int/malaria/publications/world\\_malaria\\_report\\_2012/en/](http://www.who.int/malaria/publications/world_malaria_report_2012/en/)

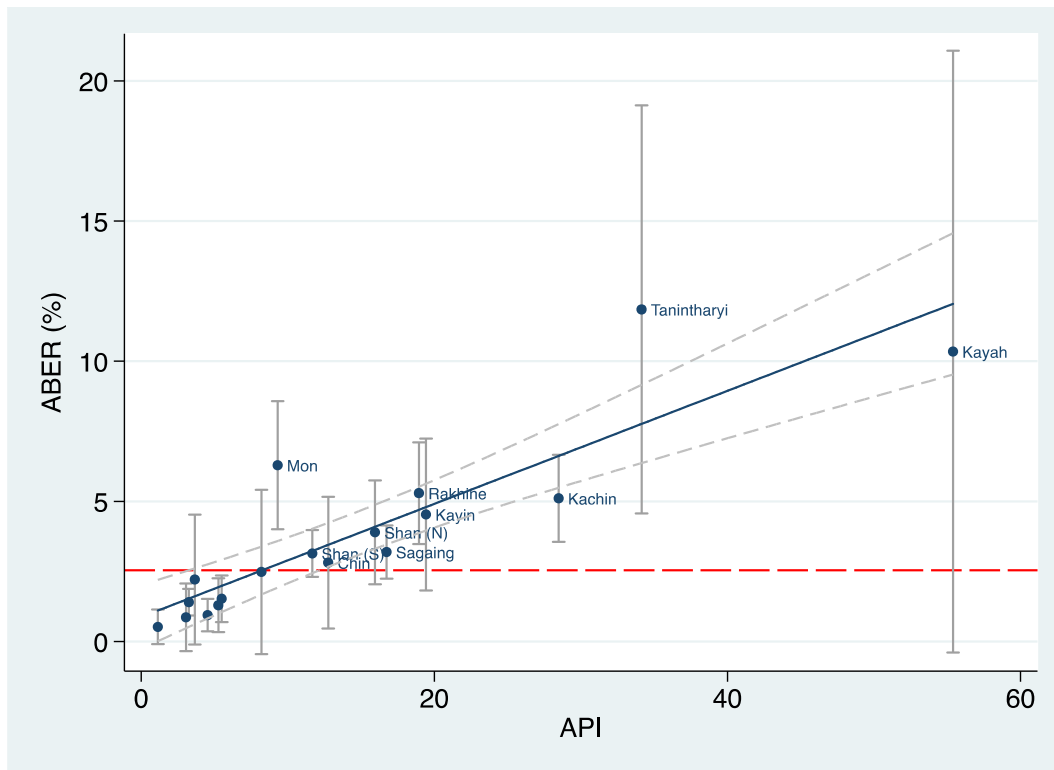


Figure 3. The relationship between ABER and API, aggregated at state/region level. The red dotted line indicates the overall national average ABER; states/regions with above average ABER are labelled.

Given the probable incomplete nature of the 2012 dataset these estimates of the ABER should be treated with some caution (although in 2011 the total number of malaria tests reported by VBDC was, at 1.1 million<sup>15</sup>, broadly similar to the number in the 2012 dataset). However, current rates are much lower than the targets for ABER recommended in a previous consultant's report<sup>16</sup> which were 20% in high risk areas (strata 1a, 1b, 1c) and 3% in probable risk areas (stratum 2). Based on national population data this translated into a requirement for 2.8 million malaria tests per year. As reported above, in 2012 results from a total of just over 1 million tests were reported by BHS and VHV's – so even after allowing for gaps in data reporting this means that a substantial increase in ABER is required. But it is also worth noting that the ABER is likely to increase substantially (and automatically) with the continued expansion of the VHV system in Myanmar. It is not coincidental that most states/regions with relatively high ABER rates (and/or relatively high rates relative to background API; Figure 3) are also those who already have a significant volunteer presence (cf. Figure A1 in Annex 2). At the township level, for example, the highest ABER (for Boke Pyin, Tanintharyi) was 38% where notably 87% of all malaria tests were carried out by VHV's (and 57% of these were PSI supported volunteers).

<sup>15</sup> VBDC (2012) Annual report, 2011. Nay Pyi Taw: Vector Borne Diseases Control Programme/Ministry of Health.

<sup>16</sup> Schapira (2012), op. cit., page 25.



It should also be noted that in the medium term the incorporation of accurate and up-to-date population data for villages within a comprehensive malaria database (with population estimates ideally based on midwife village headcounts, see Section 5.1.2) will enable ABER to be calculated with much greater precision and for appropriate targets for ABER to be determined (and monitored) at township level. To detect decreases in malaria incidence, the ABER should ideally increase year on year; moreover, during a malaria elimination phase the level of diagnostic activity should be reviewed each month in high-risk foci. Clearly this is a medium-long term scenario in Myanmar but it is nevertheless worth underlining the fact that this level of monitoring would only be feasible using a malaria database containing village-level indicator data.

### 4.2.3 Slide and test positivity rates

Another surveillance metric that is often used as an indicator of coverage is the slide positivity rate (SPR), the percentage of examined slides found positive (or alternatively the test positivity rate (TPR) in situations where blood slides and RDTs are both used routinely). Compared to the API, TPR is relatively insensitive to changes in reporting rates, diagnostic practices and health facility utilization rates (because these artifacts affect both the numerator and denominator). Therefore as well as representing fairly robust measures of malaria risk, SPR and TPR may also be useful for highlighting areas where reported API rates appear to be anomalous.

In 2011 the positivity rate for blood slides in Myanmar was reported to be 29%, which represented a marked reduction in SPR from previous years<sup>17</sup>. For RDTs the positivity rate (for *P. falciparum* only) in 2011 was 47%. The data for 2012 reviewed during the current assessment indicate that the positivity rates for slides and RDTs were 32% and 36% respectively – and that the overall TPR was 36% (Table 2). As such there appears to be some evidence of a drop in the RDT test positivity between 2011 and 2012 (which might relate to an increase in the proportion of tests being carried out by VHVs, particularly those supported by NGOs and INGOs – see below). However, the overall TPR is still relatively high and probably indicates that the decision to test is currently based on overly restrictive criteria and that both BHS staff and volunteers should be encouraged to test more widely. In a pre-elimination phase the TPR would be expected to be <5%, although a more appropriate short term target in this case would probably be 10-20%, which nevertheless would only be achievable with substantial increases in ABER<sup>18</sup>.

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<sup>17</sup> VBDC (2012), op. cit., page 26

<sup>18</sup> These metrics are fundamentally related; for any given level of API, TPR will decrease as ABER increases ( $API=(ABER*SPR)/10$ ).

Table 2. Total, positive and negative malaria tests carried out by RDT and microscopy in 2012

Diagnostic method	Test result		Total*
	Negative	Positive	
RDT	601,711 (64.0%)	338,188 (36.0%)	939,899 (100%)
Microscopy	64,531 (67.6%)	30,930 (32.4%)	95,461 (100%)
Total	666,242 (64.3%)	369,118 (35.7%)	1,035,360 (100%)

\*Note: excludes 1,235 records with no stated diagnostic method.

From Figure 4 it is apparent that TPR is relatively high, even in states/regions that have relatively low API (and which might otherwise be considered a suitable target for pre-elimination/elimination activities). Moreover, an analysis of TPR at township level reveals a high degree of variability with some townships having TPRs in excess of 60%, notably in Kachin and Sagaing (see Figure A2, Annex 2).

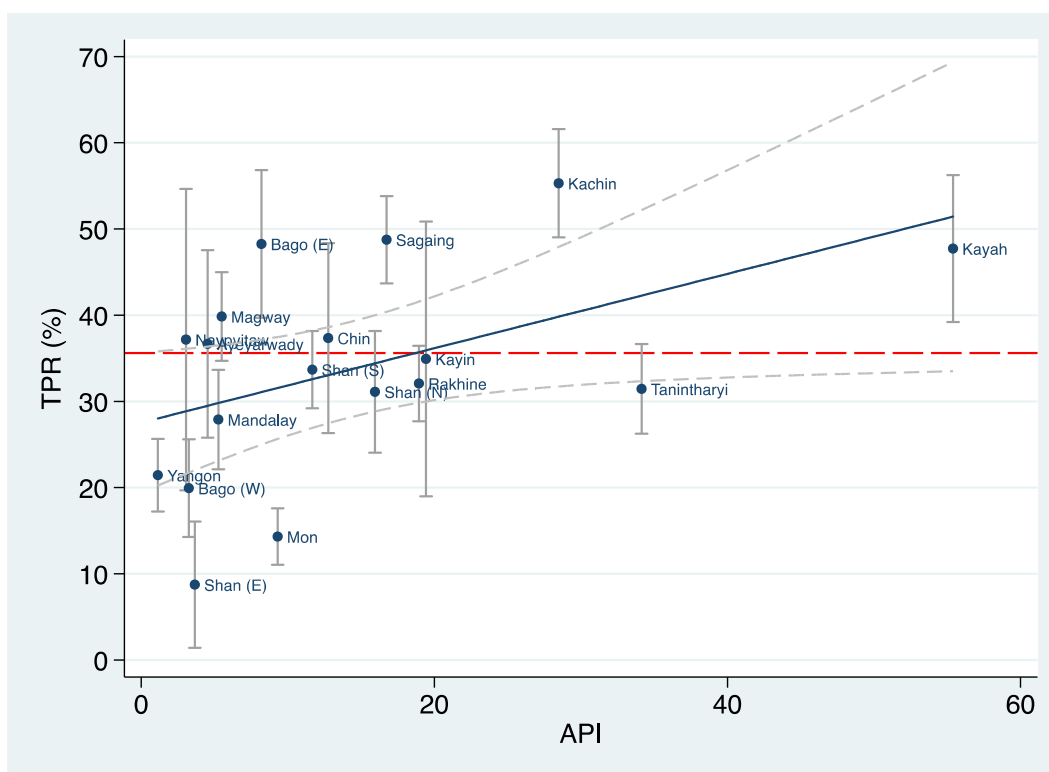


Figure 4. Relationship between TPR and API, aggregated at state/region level. The red dotted line indicates the overall national average TPR

Areas characterized by a combination of low ABER and high TPR could be indicative of either (a) poor coverage of existing public health facilities and a consequent need to introduce VHVs to improve access to curative services, or, alternatively, (b) the fact that VHVs have already been introduced to an area but that data from these volunteer villages are not being routinely captured by the surveillance system. Unfortunately, given the current limitations of the VHV dataset and the lack of accurate listings of trained VHVs per township, it is not currently possible to shed further light on this, although this is clearly an issue that needs to be addressed urgently.

One phenomenon that is apparent from the 2012 malaria dataset is a substantial difference between TPR in the BHS and VHV datasets. The overall positivity rate for tests carried out by BHS was 40.4%, compared with a TPR of 18.7% for VHVs, which suggests that the VHV network is an effective mechanism for testing a greater number of “possible” (as distinct from “probable”) malaria infections. Interestingly, among VHVs the TPR varied considerably depending on the supporting agency. For NMCP volunteers the average TPR was 33%, while the average for NGO/INGO volunteers the figure was much lower, at 16%. It is possible that this reflects systems of financial compensation being used by NGOs and INGOs, which in some cases are likely to encourage relatively wide screening of individuals in the VHV village<sup>19</sup>.

A matter of some concern in Table 2 is the relatively small number of individuals tested using microscopy - 95,461, or 9% of all tests carried out. As the VHV network expands it is of course expected that proportion of microscopy-confirmed (relative to RDT-confirmed cases) will decline. However in 2011 VBDC reported that 312,689 blood slides were examined, which is over three times the 2012 total, representing a marked absolute decline in the use of microscopy (not all of which can be explained by a reduction in transmission). During field visits carried out under the current assessment, BHS reported that microscopy was not used routinely below the level of a TH. National BHS data for 2012 appear consistent with this: at SH level 87% of malaria tests were carried out using an RDT and for THs this figure was 56% (see Table A1, Annex 2). From our discussions with NMCP management it is clear that there is real concern over loss of capacity in this area and currently NMCP are actively scaling up provision of microscopy training<sup>20</sup>. This will be especially important given current concerns about potential spread of artemisinin resistant parasites – and of course in the longer term in the context of elimination.

As mentioned above, TPR can be used as an alternative to API for identifying areas of high malaria transmission. In the case of Myanmar there is a general positive correlation between API and TPR (Figure 4), although this relationship is characterized by a fair degree of scatter. It is notable that states and regions with a significant VHV presence

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<sup>19</sup> As an example, PSI provides compensation of K500 (about US\$0.50) per malaria test and an additional K500 for positive cases detected, up to a limit of K15,000 (~US\$15) per month.

<sup>20</sup> Ministry of Health (2010) National strategic plan for malaria prevention and control, Union of Myanmar, 2010-2015. Nay Pyi Taw.

tend to have a relatively low TPR relative to their API. In contrast there a small number of regions/states where the TPR is relatively high given the API - in particular Sagaing, Kachin and Bago East, which suggests that in these areas the routine surveillance system may not be failing to capture a significant number of malaria cases. With the introduction of a village level database it would be possible to examine patterns of TPR at a more disaggregated level and also to formally analyze geographical accessibility to curative services, either through health facilities or volunteers.

#### **4.2.4 Annual parasite incidence (API)**

There are multiple caveats involved in deriving incidence estimates from routine surveillance data<sup>21</sup>. Most obviously only cases presenting at government health facilities, or in the case of Myanmar, VHVs, are included (as noted earlier in Myanmar the proportion of people with malaria who seek treatment in the private sector is unknown but generally considered to be substantial). Also, detailed information on the number (and type) of facilities and volunteers reporting in any given month is required. These data are rarely available within aggregated datasets available at national level – and in the case of Myanmar this information is not readily available from disaggregated case data either. At a more basic level, reliable incidence estimates are only possible where accurate population data are available for the administrative unit of interest. Given these potential limitations, the API data presented here are not intended to be definitive – but instead are meant to illustrate general spatial patterns of malaria risk at the national level and to frame discussions about future surveillance options moving forward.

Based on compiled malaria data for 2012 and using population data from Township Health Profiles (available from MIMU), the average national API for Myanmar in 2012 was 6.7<sup>22</sup>. However, if the population denominator is restricted to townships reporting malaria test data in 2012, this API estimate increases to 8.9.

Historical comparisons of annual API estimates should always come with multiple caveats, although over the last decade national API estimates for Myanmar do appear to have been relatively stable. API declined from 14 per 1000 per year in 2002 to 9.3 in 2006 and between 2007 and 2011 varied within the range 10-11.6<sup>23</sup>. Taken at face value the 2012 API estimate therefore represents a reduction in malaria incidence that could either be interpreted as a true decline in malaria transmission or, alternatively, as an indication that an increasing number of cases (and specifically those presenting to VHVs) are not being captured by the routine surveillance system.

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<sup>21</sup> For a comprehensive discussion of these see: Cibulskis RE, et al. (2011) Worldwide incidence of malaria in 2009: estimates, time trends, and a critique of methods. *PLoS Med* 8: e1001142.

<sup>22</sup> API was calculated using a national population estimate for 2009, which was then updated to 2012 using UN population growth rate estimates. The resulting population, 54,917,356 is about 13% higher than the population estimate used by VBDC in its calculation of API in 2011. Applying VBDC's 2011 population estimate to the 2012 dataset would increase the estimate of API from 6.7 to 7.6.

<sup>23</sup> VBDC (2012), op. cit., page 26.

In a broader historical context these incidence rates are still relatively high when compared to the 1960s and early 1970s, when the total annual number of positive cases was typically below 10,000, the API was below 1 and the SPR rarely exceeded 3%. But the current national API rate is not representative of all endemic areas and as would be expected, current patterns of malaria are distinctly heterogeneous spatially (Figure 5), with areas of relatively high incidence being largely restricted to Kachin, Sagaing and Rakhine and to townships in eastern fringe areas in Shan state and bordering Thailand. When API is estimated at township level (Table 3), of 256 townships reporting malaria cases in 2012, 43% had an API of 5 or less and the combined population of these townships was around 22 million. Ten townships had an API above 50 and these represented only 1.4% of the total national “at risk” population.

Table 3. Number of townships and total population at risk per API category

API category	No. of townships		Population	
≤1	47	(18.4%)	9,702,995	(23.8%)
1.01 – 5	64	(25.0%)	12,146,227	(29.8%)
5.01 – 10	48	(18.8%)	7,739,260	(19.0%)
10.01 – 25	53	(20.7%)	6,951,717	(17.0%)
25.01 – 50	34	(13.3%)	3,699,097	(9.1%)
>50	10	(3.9%)	570,250	(1.4%)
Total	256	(100%)	40,809,546	(100%)

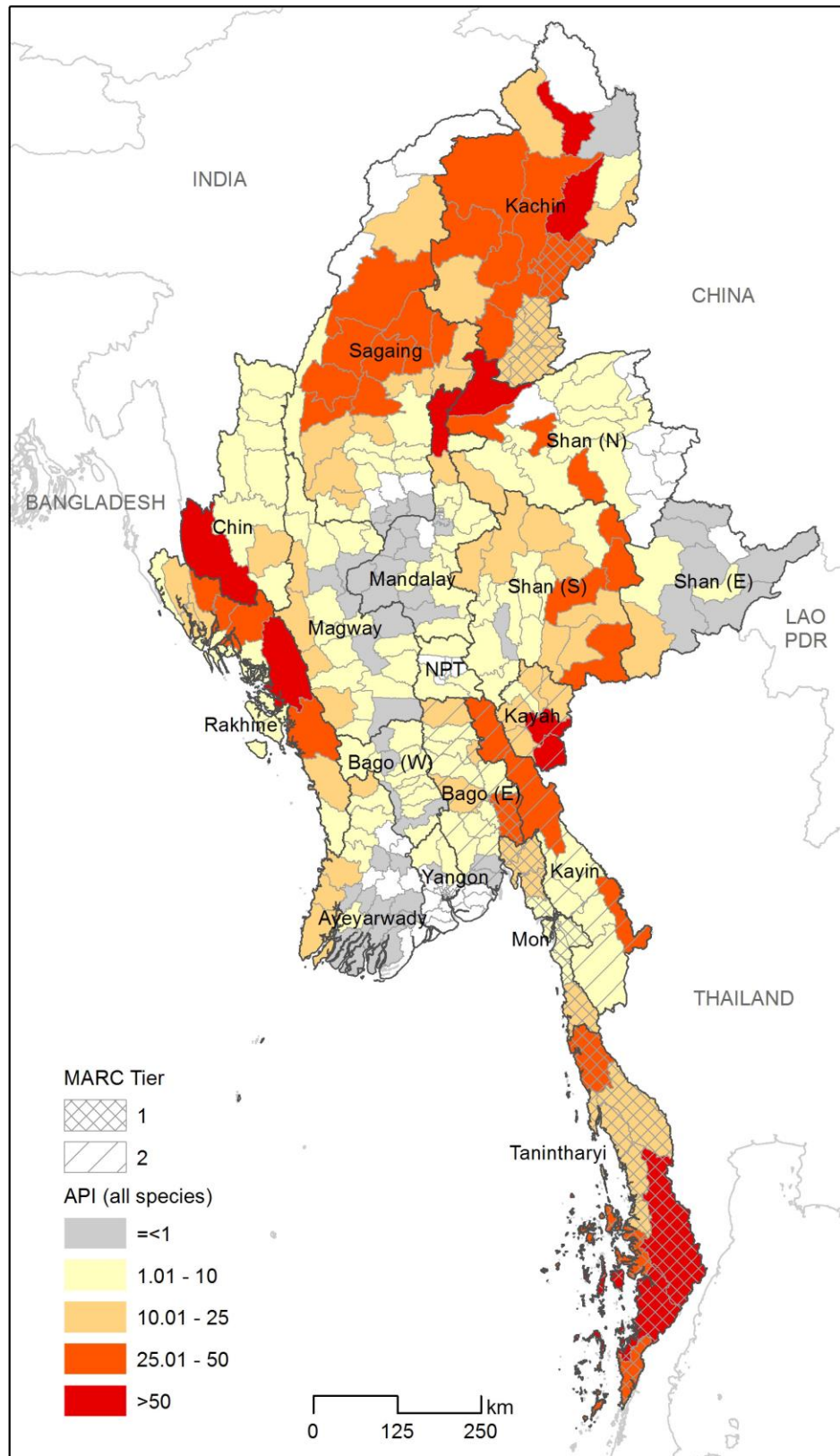
#### 4.2.5 Implications for future surveillance strategies

It is widely accepted that the appropriate design for malaria surveillance depends on both the level of malaria transmission and the resources available to conduct surveillance<sup>24</sup>. For simplicity two broad surveillance options are usually presented: (a) systems appropriate for a malaria control phase (involving manipulation of aggregated data and associated response at a population level); and (b) case-based systems that are appropriate for supporting a malaria elimination phase.

In Myanmar the relevance of this distinction is debatable. In a control phase it is usually assumed that high caseloads make the use of case-based reporting impractical; however it is clear from evidence presented in this report that at the peripheral level BHS and volunteers are quite capable of generating routinely the kind of high quality data required for an effective case-based system.

<sup>24</sup> WHO (2012) Disease surveillance for malaria elimination. Geneva: World Health Organization

Figure 5. API for all malaria species in Myanmar, 2012. Blank townships indicate absence of malaria test data in the 2012 compilation or absence of population data. (Note: maps of species specific API and a summary of state/region species ratios are presented in Annex 2).





As discussed earlier, in Myanmar the main problem currently appears to be the lack of appropriate data management. This effectively means that the real value of case-based reporting is not being harnessed (or, to put it more bluntly, that much of the current effort being spent generating electronic case-based data is wasted). However, with the introduction of new data management capacity at appropriate levels in the health system it should in theory be relatively straightforward to develop a surveillance system that more effectively uses case-based data to generate indicators for individual health facilities or villages, and/or for specific population groups (e.g. marginal populations, migrants) that can then be used to target interventions more precisely and to monitor service availability and provision more efficiently. Care will be needed in the design and phasing of such a data management system and the next section of this report includes specific recommendations relating to these considerations. The main recommendations that follow from the assessment of available BHS and VHV data for 2012 are:

### **Recommendations**

- ***The current routine practice of zero reporting is vitally important and must be maintained. Any future database system should be capable of incorporating these reports so that they can be reflected in assessments of data coverage and completeness***
- ***In the short term (and in parallel to any database development) a simple system for township and state/region health offices to track and report data reports received and submitted is required urgently***
- ***Future development of data management systems must incorporate standardized look up lists for the names of health facilities, villages and volunteers***
- ***A short-term priority is to establish an accurate register of trained VHVs with case management responsibilities. This list should be maintained by NMCP, and include regular updates from relevant NGOs and INGOs***
- ***In the medium term a malaria database should incorporate capacity to monitor TPR and ABER at township level or below, and to set appropriate targets for these metrics. These targets should be linked to control/elimination strategies on region/state basis and should also take into account containment tier. BHS and VHVs should be encouraged to test a wider range of individuals as a matter of routine.***
- ***Further investigation is needed into some apparent anomalies in the 2012 data compilation, including gaps in VHV data reporting and possible data gaps in administrative areas with very low ABER or high TPR relative to their API.***

## 5 Discussion

### 5.1.1 Surveillance tools for malaria elimination

Experiences from many countries have shown that for eliminating a disease the official HMIS system is normally not sufficient to cover the data needs and the introduction of a disease specific case based surveillance system with its own database will be required. Furthermore, as a country moves towards malaria pre-elimination and eventually elimination there is a need not only for case-based reporting for but also for *real time* case-based reporting to allow for direct response to each case as it is detected rather than waiting until the end of a particular reporting period.

The need for more real time surveillance requires innovative solutions that use technologies that are appropriate to the severe resource constraints in funding, manpower in the field, and technical capacity at central level to develop and manage systems, that exist in developing countries. There needs to be an emphasis on simple, sustainable and cost effective solutions.

The national program in Thailand is already set up to respond to all cases close to real time due to the limited number of cases and the policy of following up all cases.

To address the needs of the national program in Cambodia to have access to real time information for containment and pre-elimination settings, Malaria Consortium worked with the national program to develop real time systems (day-3 positive and day-0 alert systems) using SMS technology.

The day-3 positive alert system uses SMS to identify patients still parasitemic after three days and alerts appropriate district officials (based on the location of the village) to take action. The system uses web based open source software to link to the MIS and Google Earth to map day 3 positive cases in order to identify hotspots of potential resistance. The system was piloted in a number of villages and health centres as part of the overall day-3 positive monitoring system where village malaria workers (VMWs) are trained to prepare blood slides to be read at the local health centre.

The day-0 (point of care) alert system uses the model piloted by the day-3 positive system. SMS are sent by village malaria workers (VMWs) and health centre staff for day-0 cases and the software automatically alerts appropriate district officials (based on the location of the village) to take action. The system is currently operating in four Operational Districts and covers 184 VMWs and 17 health centres to report all cases of *P. falciparum* and features a unique threshold system that allows it to be used in elimination settings to identify individual cases and in high transmission settings to identify possible outbreaks

In Cambodia there are also pilot projects underway where the private sector is incentivised to test fever patients and refer positive patients to the nearest health facility



for treatment. An essential drug alert system is used whereby health facilities facing a shortage of malaria drugs can send an alert by SMS and which displays on a web based interface that malaria control staff can use to move drugs from well stocked facilities to the facility facing a shortage.

In Myanmar at present the state of the communication system is such that these approaches are not yet viable but the country is undergoing rapid changes in this area and things that seemed impossible only a year or two ago (such as free SIM cards and widespread 3G coverage) are now happening at a fast rate. Almost all of the BHS staff interviewed during the current assessment reported having their own mobile phones or access to a mobile phone and with the awarding of new licenses for mobile networks and the expected increase in coverage and decrease in prices all of these approaches will start to become viable.

### **5.1.2 Villages names and coding systems in Myanmar**

The administrative structure of the country is shown in Figure 6 with the most significant administrative levels being state/region and township.

When doing any kind of surveillance or reporting by administrative unit; it is absolutely essential that everyone involved works from the same list and uses a common coding system otherwise it is not possible to merge data from multiple sources. A lack of a common coding standard can complicate data management when trying to match lists of villages sent in by the various partners that do not include codes and are written using different spellings, sometimes in Burmese and sometimes in English.

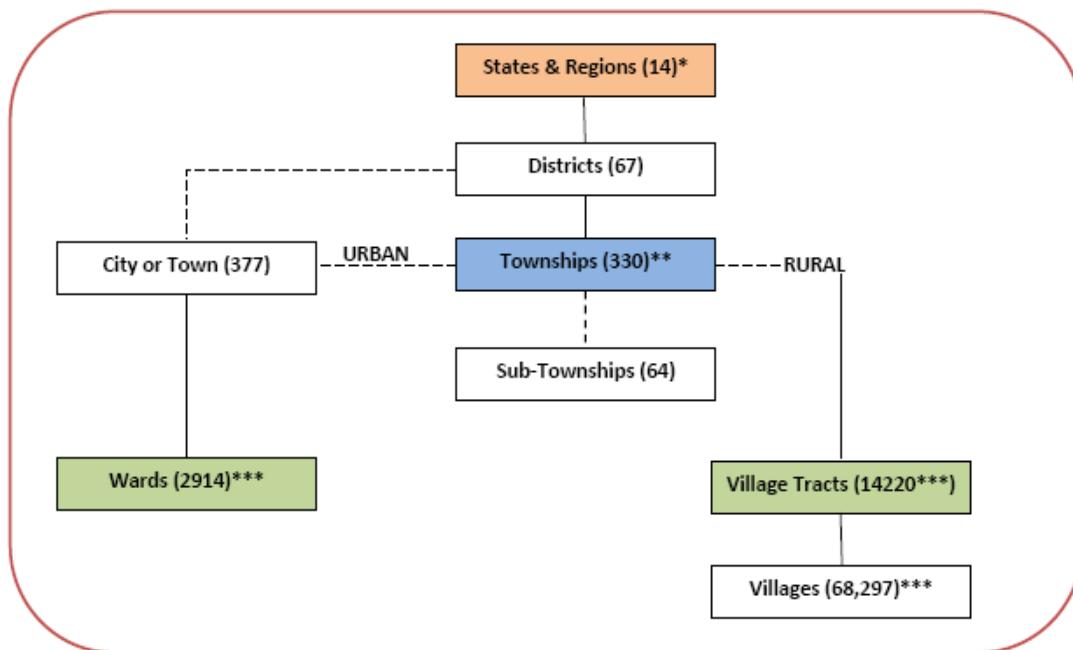
The last census of the country was more than 20 years ago and there is no newer “official” list of villages in the country although there are plans to conduct a national census in 2014. In the absence of an official village list the most often used list is that published by the Myanmar Information Management Unit (MIMU) which is used by NMCP and many of the implementing partners consulted during the current assessment. MIMU works with government, NGOs and INGOs to maintain a list of all the administrative units in Myanmar down to village/ward level and makes this information freely available via their website<sup>25</sup>. Shape files for GIS mapping are also available online.

MIMU itself and many of the implementing partners mentioned that the accuracy of the data is variable but everyone recognizes that it is the best source of village data available and MIMU seem to be keen to work with NGOs and other UN agencies to continually update the village list.

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<sup>25</sup> <http://themimu.info>

### Myanmar Administrative Structure



For Information Management Purposes the MIMU promotes 3 levels for data collection and reporting

- Admin 1-First sub-national level
- Admin 2-Second sub-national level
- Admin 3-Third sub-national level

Source: General Administration Department, Ministry of Home Affairs, 2009

\*There are only 14 States and Regions however, Shan States is subdivided into 3 Sub-States;

Bago Region is subdivided into 2 sub-regions.

\*\* Of the 330 Townships, 33 are urban, 3 are rural and, 294 are mixed.

\*\*\*This number in the MIMU Pcode list release IV, which also includes settlements as reported by UN and NGOs field offices is differs from the GAD list.

Figure 6. Administrative Structure of Myanmar (from MIMU)

As the NMCP moves towards village level reporting (i.e. including information about the patient's village that is already entered into the case register) it is essential that the township database includes a current listing of all the villages in the township, preferably with up-to-date populations. Some individuals have expressed the view that this process would somehow be too "complicated" to be justifiable, but this report does not share this view. Whilst obtaining a list of all villages in the country or even at state/region level may

be a challenge, at township level and below there are longstanding systems in place for keeping accurate lists of villages with populations that are updated on a regular basis.

2013 ဂျပီ:စက္တား: (NCA)

အိမ်ထောင်စဉ်နံပါတ်	<1	1-2	3-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	စုစုပေါင်း																			
ကျေးရွာအုပ်စု	5	4	10	7	13	12	9	5	7	13	27	34	25	21	29	35	29	25	27	25	30	27	29	23	25	19	20	20	12	9	9	8	8	12	8	7	326		
ကျေးရွာ	3	1	4	3	6	6	3	5	7	9	7	9	10	11	10	11	9	9	7	9	13	12	16	16	9	10	9	11	11	12	5	6	3	4	3	2	11	139	
ကျေးရွာအုပ်စု	3	-	2	2	5	1	4	2	2	3	6	7	7	7	6	9	5	9	5	14	8	9	9	5	6	8	3	5	6	5	4	2	3	2	4	1	2	85	
ကျေးရွာအုပ်စု	7	3	7	4	13	13	5	7	11	5	15	14	14	16	20	21	20	16	23	13	12	18	17	18	18	15	16	11	15	8	8	5	4	4	4	-	1	23	
ကျေးရွာအုပ်စု	2	2	2	5	4	4	3	2	3	11	11	12	10	12	10	12	11	10	10	10	12	9	10	9	10	8	12	6	11	3	5	2	2	-	2	4	2	3	20
ကျေးရွာအုပ်စု	1	3	6	5	10	3	8	6	6	21	23	20	28	19	17	19	16	23	28	15	15	17	18	11	10	15	14	14	8	5	9	2	6	2	4	2	3	20	
ကျေးရွာအုပ်စု	2	2	2	-	2	2	3	4	3	3	4	4	3	4	5	6	2	3	5	3	4	3	3	3	1	1	1	-	2	1	1	-	1	-	1	-	-		
ကျေးရွာအုပ်စု	6	2	8	4	12	9	8	10	14	11	25	29	27	24	23	28	21	13	21	16	21	23	18	26	14	16	9	8	11	10	7	9	5	11	1	4	11	4	
ကျေးရွာအုပ်စု	3	6	4	4	4	4	3	4	9	10	15	16	12	13	14	15	18	19	20	24	16	9	14	10	9	12	12	12	-	2	10	17	6	3	1	-	1	-	
ကျေးရွာအုပ်စု	2	-	4	3	3	3	2	3	4	5	2	2	3	3	5	3	5	7	3	2	3	3	2	4	3	2	2	2	-	2	2	1	2	-	-	-	-		
စုစုပေါင်း	34	23	49	37	67	64	44	51	66	68	132	144	139	139	142	154	139	139	132	156	129	128	134	138	105	116	93	101	80	85	58	62	38	41	22	32	25	31	
	57	86	131																																				

1. ကျေးရွာအုပ်စု: <5 = 51, <1 = 9, <3 = 17, <15 = 80, NCA = 199  
 2. ကျေးရွာ = 23, = 4, = 9, = 16, = 61  
 3. ကျေးရွာအုပ်စု = 13, = 3, = 4, = 5, = 55, = 106

Figure 7. Midwife village list and head count

In all of the townships visited each midwife had a standardized village list and head count that they are required to update annually (a process that can take each midwife several weeks to complete) and it is understood that this system has been in place nationally for some time<sup>26</sup>. Of course there may be parts of the country where particular local conditions mean that accurate population/village lists do not exist; however, this report feels that it is definitely a feasible approach to systematically introduce, on a township by township basis a village module whereby the data assistant maintains the village list (using MIMU codes) in both English and Burmese. Data for tests carried out by BHS (which already includes the village name) would then have the patient village entered via a drop down list. These village data would then be merged with the village data from the VHV case registers to provide village-level incidence estimates that can be used for detailed planning, mapping and as inputs into the micro-stratification process.

<sup>26</sup> In a previous consultancy in 2003 one of the authors of this report found exactly the same situation with midwives, which suggests that this is a longstanding, stable and reliable system.

## **Recommendations**

- ***NMCP and their implementing partners adopt MIMU coding standards for place names***
- ***As the NMCP moves towards introducing village level reporting at township level, data assistants should maintain village lists based on the midwife village head counts using the MIMU codes***

This will involve some initial work to match the midwife village lists with the MIMU villages, identify villages that are missing from the MIMU dataset and work with MIMU to add these villages to the MIMU listing. The effort involved in doing this will vary from township to township but will be a one-off process.

### **5.1.3 Micro-stratification**

Micro-stratification of villages was carried out in 80 UNICEF supported townships in 2008 and the results published by SC with a breakdown of the number of villages in each stratum<sup>27</sup>. The 80 townships included 21 townships in MARC Tier 1 (10 out of 21) and Tier 2 (11 out of 31). At present there is some updating of the stratification in the UNICEF townships and a program to stratify villages in an additional 100+ townships supported by GF. The process of re-stratification of a UNICEF township was observed in Thandwe where the midwives and the district malaria staff used hand drawn maps and other data such as distance from the forest and the existence of breeding sites to determine the new stratification for each village.

The new list of village stratification was reported up to the state level and a summary (numbers of village in each stratification level) was sent to the central level. At central level NMCP using the stratification to inform decisions on ITN distribution (with villages in stratum 1a being the principal recipients of these).

Under the existing system lists of all villages by stratification are available at all levels up to state/region but are not available at national level. Whilst it is most important that the lower levels have this information it is pointed out that if the database (recommended by the report) is introduced this sort of detailed information will be easily available at all levels up to the central VBDC<sup>28</sup>.

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<sup>27</sup> UNICEF/JICA/VBDC (2008) Malaria Risk Micro-stratification in UNICEF 80 townships.

<sup>28</sup> Although the current paper and spreadsheet data compilation systems both have field for village stratification it appears that this information is not recorded routinely, or accurately. The value of requiring BHS and data assistants to record this information is therefore debatable.





Although a village-level malaria database would not directly replace the current system of micro-stratification in Myanmar, its introduction could certainly contribute to the process and make the stratification system more efficient by providing objective, accurate data on malaria incidence for individual villages. In terms of the micro-stratification process this would potentially remove some burden from BHS staff (who are not always comfortable with the process<sup>29</sup>) and allow activities to focus more on characterizing in a more rigorous and reproducible manner the ecological and entomological aspects of malaria risk in each SC. It is also worth noting that while a malaria database would also be able to provide annual, updated data for village-level malaria incidence across the whole country, the relatively intensive system of micro-stratification that currently exists is only designed to be updated every three years (and even this is contingent on funding).

### **Recommendation**

***In parallel with development of the village-level malaria database, current approaches to micro-stratification should be re-assessed with a view to incorporating routinely available village-level malaria incidence data.***

#### **5.1.4 Suggested design of the malaria surveillance database**

As current data entry tools (case registers *etc.*) are well designed the malaria database should be designed to allow for the efficient data entry of current versions of forms to allow data from all levels (township to national level) to be collated, analyzed and presented in ways that are useful for program managers, policy makers and other stakeholders.

The essential elements of a database should include the following:

#### **Data Entry**

The database should have the data entry screens for:

- All BHS test data (both positive and negative tests) using the format of the existing BHS case register;
- All VHV test data (both positive and negative tests) using the format of the existing VHV case register;
- VHV details such as village name, age, sex, training *etc.*;
- Village listings including location, supervising health facility, distance from nearest facility, official (midwife head count) population and whether the village has malaria volunteers;
- Health facility listing including type of facility and location;

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<sup>29</sup> UNICEF (2010) Evaluation of malaria micro-stratification strategy.

- ITN/LLIN distribution and retreatment data by village;

## **Reporting**

Reports should be customizable by place (down to village level) and time and include:

- VHV test data aggregated by village, township, state/region and national;
- Health Facility positive case data aggregated by village, township, state/region and national level;
- VHV details such as village name, age, sex, training, contact details *etc.*;
- Village listings including location, supervising health facility, distance from nearest facility, population (midwife head count) and whether the village has a volunteer;
- Health facility listing including type of facility and location;
- ITN/LLIN distribution by village, township, state/region and national level;
- Township bulletin which summarizes all aspect of the township malaria data into a single simple report for feedback to township and facility staff;
- National level reporting according to the formats required by the NMCP and donors.

## **Graphing and exporting of raw data**

The malaria database should be able to export data graphically in a format that can be cut and pasted into WORD or EXCEL and raw data should be able to be exported in a number of formats that can then be analyzed by statistical software.

## **Mapping**

All data within the within the database including village locations, health facilities should be geocoded and be able to be displayed GIS software such as Google Earth.

Data should be able to be automatically exported from township and state/region and imported into the national level database.



## 6 List of recommendations

### To improve the data management and processing of malaria data in Myanmar

1. All NGOs, INGOs and other implementing partners that use volunteers should use the government system of carbonless case registers. In addition to any requirements from the partners to provide the central VBDC with periodic summary reports the carbonless copies from the volunteers should be sent to the relevant township health office.
2. Central VBDC should issue clear guidelines to the NGOs and other implementing partners regarding the format of the quarterly summary report they are required to submit. To improve the data management of these data it would be sensible to provide a soft copy template in EXCEL to make combining the data more straightforward.
3. Central VBDC should issue clear guidelines to states/regions and townships as to how to report volunteer data and this report recommends that the system used in Mandalay whereby the volunteer data are aggregated and reported alongside the health facility data within the same timeframe as the BHS data is the most appropriate model.
4. Long term technical assistance (TA) should be considered in the area of surveillance and data management to support the national program and partners to coordinate the development and implementation of the malaria case-based reporting system; the phased introduction of village level reporting at township level and improve the capacity of the national program staff to manage the data particularly at township and central level.
5. An ACCESS database should be developed for national level, states/regions and townships to manage the large amount of data currently being processed by the EXCEL spreadsheets. The database should be designed to initially directly replace the existing spreadsheet functionality plus bed net distribution data but should have a village management module which would initially be de-activated at state level and at township level until such time that townships are in a position to move, in a phased approach, to true village based reporting with a minimum of disruption.
6. NMCP and their implementing partners should adopt MIMU coding standards for place names.
7. As the NMCP moves towards introducing village level reporting at township level data assistants should maintain village lists based on the midwife village head counts

using the MIMU codes. These should include information on deployment of VHVs and other services.

### **To improve the IT infrastructure in the NMCP**

8. For state/region or township offices there should be a backup plan for the breakdown of data assistant computers, ideally townships should also have a general desktop computer that could also be used by the data assistant should their laptop breakdown.
9. The IT infrastructure at central VBDC needs upgrading with a network, server and procedures for sharing and backing up data. Email and internet access is essential for the states and townships to email their monthly updates and other reports.

### **To maximize the utility, quality and coverage of surveillance data**

10. Routine practice of zero reporting is vitally important and must be maintained where it is carried out routinely (and introduced where this is not the case). Any future database system should be capable of incorporating these reports so that they can be reflected in assessments of data coverage and completeness.
11. In the short term (and in parallel to any database development) a simple system for township and state/region health offices to track and report data reports received and submitted is required urgently.
12. A short-term priority is to establish an accurate register of trained VHVs with case management responsibilities. This list should be maintained by NMCP, and include regular updates from relevant NGOs and INGOs.
13. In the medium term a malaria database should incorporate capacity to monitor TPR and ABER at township level or below, and to set appropriate targets for these metrics. BHS and VHVs should be encouraged to test a wider range of individuals as a matter of routine.
14. Further investigation is needed into some apparent anomalies in the 2012 data compilation, including gaps in VHV data reporting and possible data gaps in administrative areas with very low ABER or high TPR relative to their API.
15. An evaluation of VHV performance should be carried out across the full range of partners operating in Myanmar. It should include an assessment of various motivational factors and should also seek to document examples of best-practice in VHV management and coordination.

**All recommendations are further explained in the body of the report.**

## Annex 1. Persons and organizations met (including scoping visit)

### National level

Person	Position	Organisation
Dr Thar Tun Kyaw	Director of Disease Control	VBDC Nay Pyi Taw
Dr Thaung Hlaing	Deputy Director (Malaria)	VBDC Nay Pyi Taw
Dr Hla Min Thein	Medical Officer	VBDC Nay Pyi Taw
Dr Than Naing Soe	Assistant Director	VBDC Nay Pyi Taw
Dr Khin Nan Lone	Assistant Director	VBDC Nay Pyi Taw
Dr Marlar Soe	Assistant Director	VBDC Nay Pyi Taw
Mr Abraham	Entomologist	VBDC Nay Pyi Taw
Krongthong Thimasarn	Malaria & Ag WR MMR	WHO
Dr Gawrie Nirdoshi Loku Galappaththy	National Technical Officer	WHO
Dr Tet Toe Tun	National Technical Officer (Malaria Unit)	WHO
Dr Nay Lynn Yin Maung	Data Manager (Malaria Unit)	WHO
Dr Myo Myint Naing	National technical Officer	WHO
Dr Khin Mon Mon	National Consultant	WHO
Ms Barbara Greenwood	Global Fund Program Director	SCF
Dr Min Min Thein	Program Manager (Malaria)	SCF
Dr Khine Shue Tun	M&E Manager (Malaria)	SCF
Dr Pietro Di Mattei	Head of Performance Management Unit	UNOPS
Dr Aye Yu Soe	Public Health Officer (TB/Malaria)	UNOPS
Dr Aye Mar Lwin	M&E Analyst	UNOPS
Mr Pyi Soe	Information System Analyst	UNOPS
Kamma Blair	M&E Officer	UNOPS
Eisa Hamouda Eisa HAMID	M&E Specialist	UNOPS
Thu Van T.Dinh	Health Advisor	USAID
Dr May Aung Lin	Country Program Director	URC
Dr Saw Lwin	Country Coordinator	URC
Mr Noel	Project Manager	Myanmar Health Assistant Assoc.
Mr Yan Naing Oo	Assistant project manager	Myanmar Health Assistant Assoc.
Mr Jasper Besemar	Operational coordinator	MAM
Dr Myint Ag Khin	Project Manager	Community Development Assoc.
Soe Thura	M&E Officer	Community Development Assoc.
Dr Zaw Lwin Oo	Medical officer	Community Development Assoc.
Dr Khayae Htun	Technical associate	World Concern
Dr Nay Yae Wyne	BCC Officaer	World Concern
Dr Nang Khaing Zar Ag	Snr HSO	PSI

Duty Station	Township	State	Name	Position/Title
Tanintharyi RHO	Dawei	Tanintharyi	Dr. Kyaw Zayah	State Health Director
Tanintharyi RHO	Dawei	Tanintharyi	Dr. Tin Tun Oo	Team Leader (Malaria)
Tanintharyi RHO	Dawei	Tanintharyi	Mr. Myint Soe	Malaria Assistant (MA)
Tanintharyi RHO	Dawei	Tanintharyi	Ms. Lwin Lwin Yamin	Data Assistant
Laung Lone Township	Laung Lone	Tanintharyi	Mr. Nay Aung	Data Assistant
Dawei Township	Dawei	Tanintharyi	Ms. Nay Zar Chi Win	Data Assistant
Thayet Chaung Township	Thayet Chaung	Tanintharyi	Ms. Mo Mo Thiri	Data Assistant
Maung Makan SH	Laung Lone	Tanintharyi	Dr. Phyo Wint Swe	Assistant Surgeon
Maung Makan SH	Laung Lone	Tanintharyi	Ms. Khin Moe Swe	Senior Nurse
Maung Makan SH	Laung Lone	Tanintharyi	Mr. Aung San	Public Health Supervisor 1
Pakari RHC	Dawei	Tanintharyi	Mr. Khin Shein	Health Assistant
Pakari RHC	Dawei	Tanintharyi	Ms. Khin Ohnmar Win	Public Health Supervisor 2
Harmyinyngyi SC	Dawei	Tanintharyi	Ms. May May Lwin	Midwife
Ahnyarphyar SC	Dawei	Tanintharyi	Ms. Naw Phaw El	Midwife
Talaitaung SC	Dawei	Tanintharyi	Ms. Khin Aye	Midwife
Thinkantone SC	Dawei	Tanintharyi	Ms. Thandar Win	Midwife
Dawei THO	Dawei	Tanintharyi	Dr. Swe Swe Aung	UHC Medical Officer
Dawei THO	Dawei	Tanintharyi	Mr. Than Tun	Malaria Supervisor
Dawei THO	Dawei	Tanintharyi	Ms. Naw Yu Yu Gal	Health Assistant
Dawei THO	Dawei	Tanintharyi	Ms. Nay Zar Chi Win	Data Assistant
Dr Myo Min	Director		Myanmar Medical Association	

### Tanintharyi Region

### Rakhine State

Duty Station	Township	State	Name	Position/Title
District Hospital	Thandwae	Rakhine	Dr. Myat Myat Moe	District Medical Officer
District VBDC Office	Thandwae	Rakhine	Mr. Myo Aung	Malaria Assistant
District VBDC Office	Thandwae	Rakhine	Mr. Tun Tun	Data Assistant
Shwe Hlay SH	Thandwae	Rakhine	Dr. Than Tun	Station Medical Officer
Shwe Hlay SH	Thandwae	Rakhine	Mr. Than Lwin	Public Health Supervisor I
Shwe Hlay SH	Thandwae	Rakhine	Ms. Yee Yee Khin	Lady Health Visitor
Shwe Hlay SH	Thandwae	Rakhine	Ms. Khin Sann Win	Staff Nurse
Shwe Hlay SH	Thandwae	Rakhine	Ms. Khin Saw Kyu	Staff Nurse
Shwe Hlay SH	Thandwae	Rakhine	Ms. Khin Tint	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. Than Than Htike	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. Myint Myint Shwe	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. Myint Myint Lwin	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. San San Myint	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. Htay Nwae	Midwife
Shwe Hlay SH	Thandwae	Rakhine	Ms. KhinThaung Kyi	Volunteer Health Worker
Shwe Hlay SH	Thandwae	Rakhine	Mr. Soe Thurein	Volunteer Health Worker
District VBDC Office	Thandwae	Rakhine	Mr. Myo Aung	Malaria Assistant

District VBDC Office	Thandwae	Rakhine	Mr. Thein Aye	Malaria Supervisor
District VBDC Office	Thandwae	Rakhine	Mr. Maung Maung Aye	Malaria Supervisor
District VBDC Office	Thandwae	Rakhine	Mr. Kyaw Htwe	Permanent Sprayman
District VBDC Office	Thandwae	Rakhine	Mr. Thein Naing	Permanent Sprayman
Linn Thar RHC	Thandwae	Rakhine	Mr. Tin Hlaing	Health Assistant
Linn Thar RHC	Thandwae	Rakhine	Ms. Nyein Ei Htwe	Lady Health Visitor
Linn Thar RHC	Thandwae	Rakhine	Ms. Myo Ma Ma	Midwife
Linn Thar RHC	Thandwae	Rakhine	Ms. Kyi Kyi	Midwife
Linn Thar RHC	Thandwae	Rakhine	Ms. Thet Thet Han	Midwife
Linn Thar RHC	Thandwae	Rakhine	Ms. Wah Wah Htay	Midwife
Linn Thar RHC	Thandwae	Rakhine	Ms. Aye Aye Maw	Midwife
Linn Thar RHC	Thandwae	Rakhine	Mr. Zaw Myint Aung	Public Health Supervisor II
Nann Chaung SC	Thandwae	Rakhine	Mr. Tin Hlaing	Health Assistant
Nang Chaung SC	Thandwae	Rakhine	Ms. Aye Aye Maw	Midwife
District Hospital	Thandwae	Rakhine	Dr. Myat Myat Moe	District Medical Officer
District VBDC Office	Thandwae	Rakhine	Mr. Myo Aung	Malaria Assistant
District VBDC Office	Thandwae	Rakhine	Mr. Tun Tun	Data Assistant
District VBDC Office	Thandwae	Rakhine	Ms. Ni Ni Aye	Ward Sister
District VBDC Office	Thandwae	Rakhine	Ms. Tin Tin Aung	Lab Technician Grade I

### Mandalay Region

Duty Station	Township	State	Name	Position/Title
Regional NMCP Office	Mahar Aung Myay	Mandalay	Mr. Sam Simm	HQ Malaria Assistant
Regional NMCP Office	Mahar Aung Myay	Mandalay	Mr. Pyae Sone Kyaw	Data Assistant
RHO	Chan Aye Thar Zan	Mandalay	Dr. Aung Myat Min	THOR
Patheingyi TH	Patheingyi	Mandalay	Dr. Khin Myo Naing	Township Medical Officer
Patheingyi TH	Patheingyi	Mandalay	Mr. Myint Maung	Health Assistant I
Patheingyi TH	Patheingyi	Mandalay	Mr. Hla Myint	Malaria Supervisor
Patheingyi TH	Patheingyi	Mandalay	Mr. Chan Aung	Public Health Supervisor I
Minn Gan RHC	Patheingyi	Mandalay	Mr. Myint Naing	Health Assistant
Minn Gan RHC	Patheingyi	Mandalay	Ms. Sann Win Khine	Lady Health Visitor
Minn Gan RHC	Patheingyi	Mandalay	Ms. Su Su Aung	Main Center Midwife

## Annex 2. Additional tables and figures

Table A1. Number of tests carried out by RDT and microscopy by facility type

Facility type	Diagnostic test				Total*
	RDT		Microscopy		
MCH	32,496	(99.0%)	320	(1.0%)	32,816 (100%)
RHC	181,707	(96.4%)	6814	(3.6%)	188,521 (100%)
SC	299,060	(99.5%)	1429	(0.5%)	300,489 (100%)
Screening point	14,793	(99.8%)	25	(0.2%)	14,818 (100%)
Station Hospital	98,472	(86.7%)	15096	(13.3%)	113,568 (100%)
Township Hospital	53,886	(56.3%)	41903	(43.7%)	95,789 (100%)
Township VBDC	44,074	(67.6%)	21119	(32.4%)	65,193 (100%)
UHC	73	(100.0%)	0	(0.0%)	73 (100%)
Not specified	1,999	(19.0%)	8542	(81.0%)	10,541 (100%)
VHV	213,339	(99.9%)	213	(0.1%)	213,552 (100%)
Total	939,899	(90.8%)	95461	(9.2%)	1,035,360 (100%)

\*Note: excludes 1,235 records with no stated diagnostic method

Figure A1. Number of VHV villages reporting per township in 2012

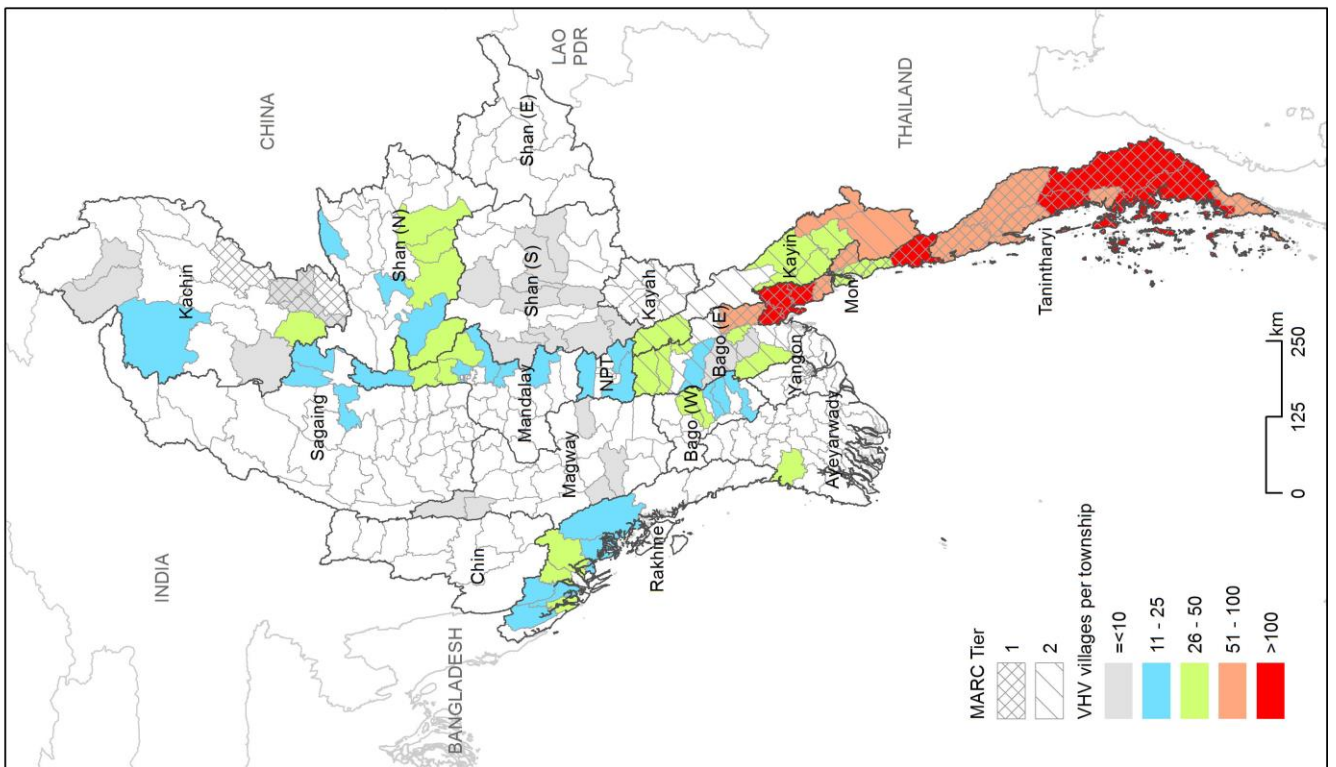


Figure A2. Test positivity rate (TPR) by township, Myanmar 2012

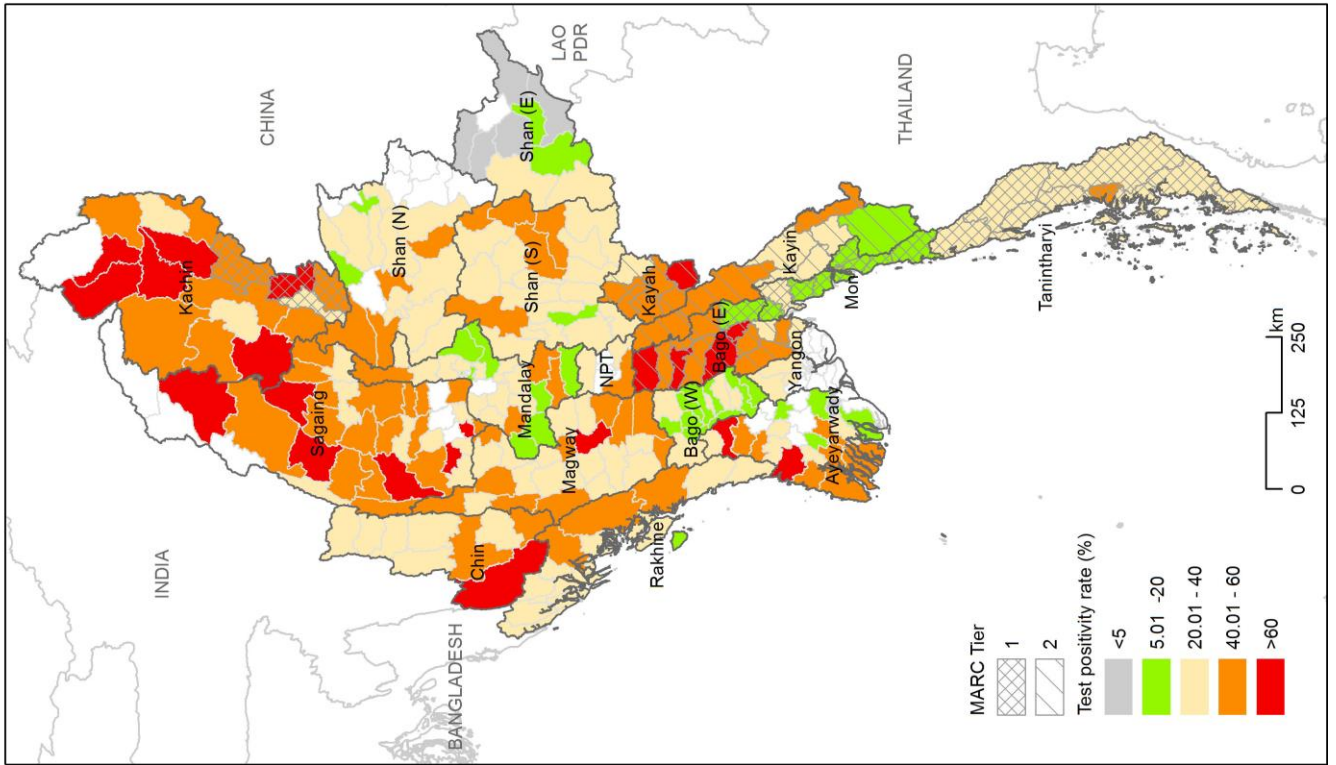




Figure A4. API (Pv only), Myanmar 2012

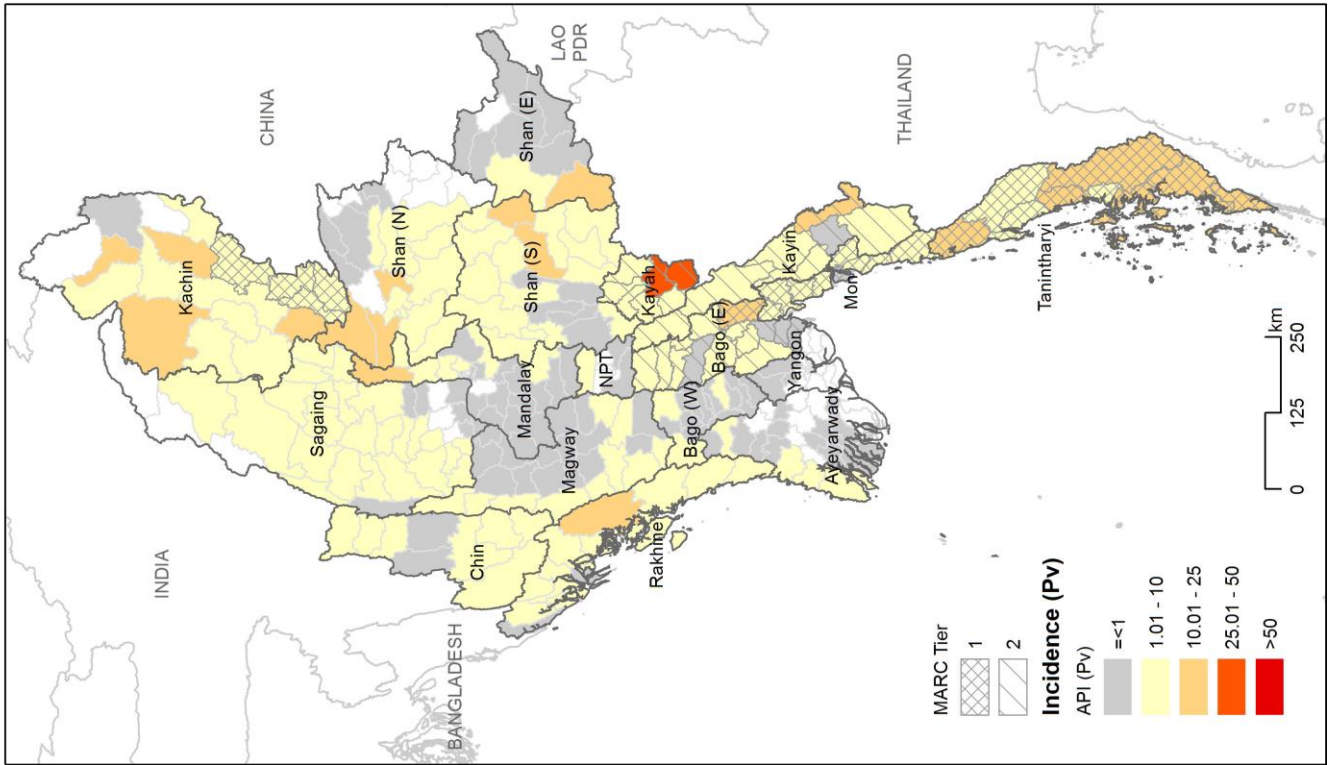


Figure A3. API (Pf only), Myanmar 2012

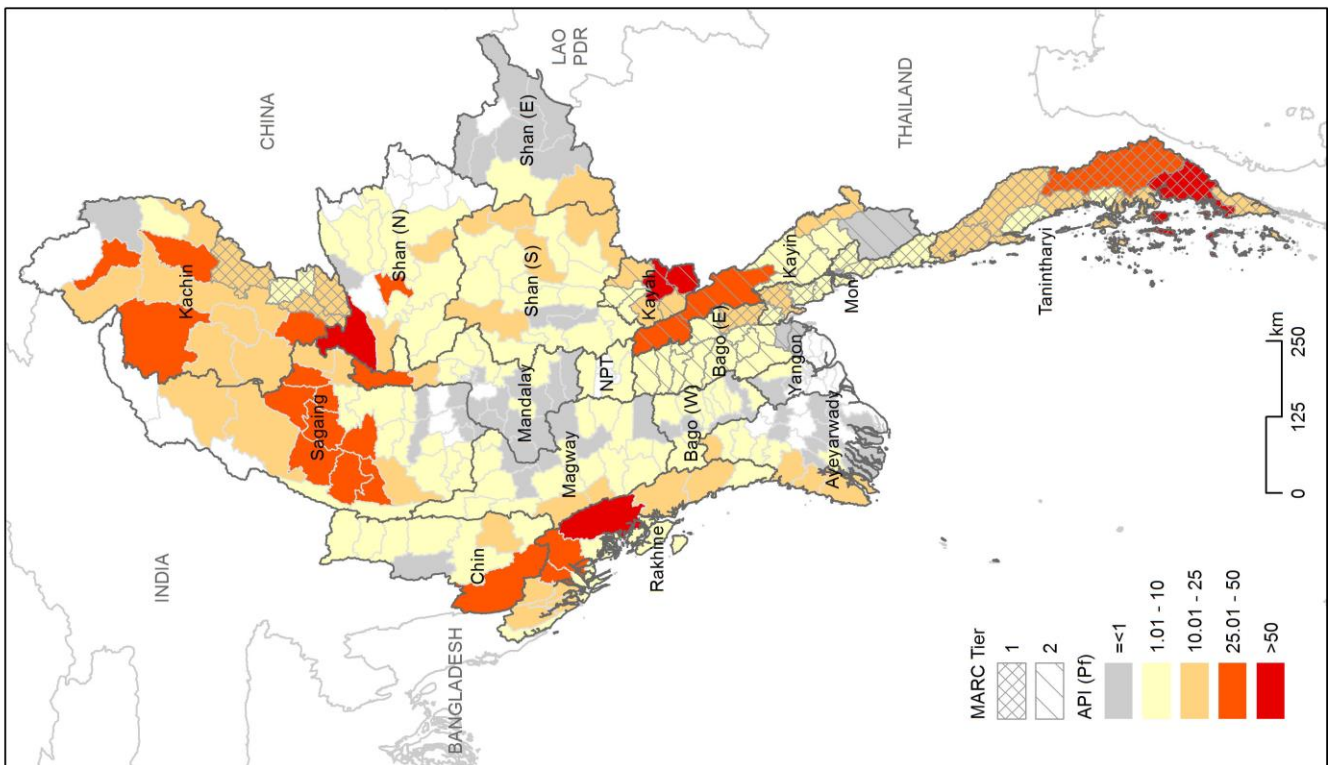


Figure A5. Parasite species ratio (Pf:Pv), Myanmar 2012

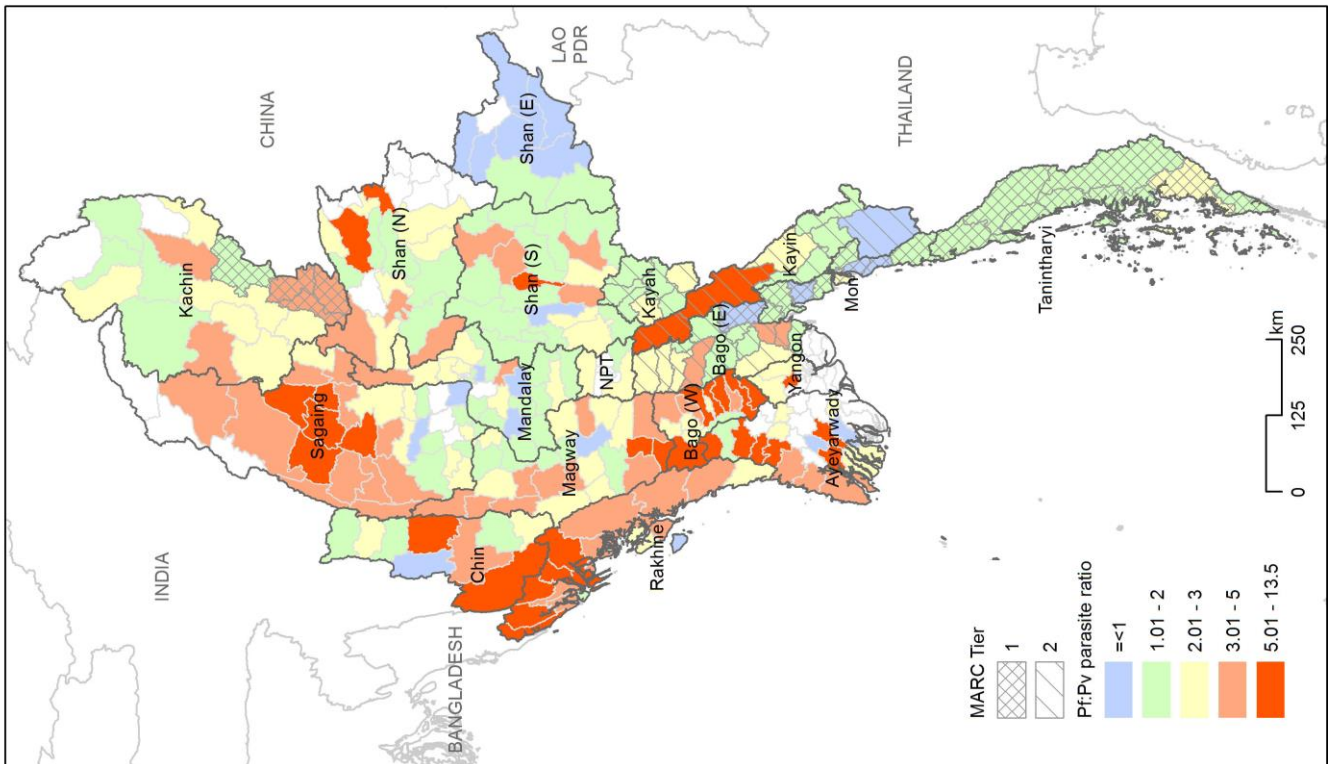


Figure A6. Proportion of Pf, Pv and mixed infections per state/region

