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Acknowledgements:

In the name of Allah, the most beneficent and merciful who gave us the strength and courage to accomplish this important task. Indeed all praise is for Him.

I would like to acknowledge the leadership of the Ministry of Public Health for their guidance, encouragement and support to accomplish this significant task and put in order the first ever published scientific journal in the health care system of Afghanistan. Moreover, I would like to express my sincere thanks to the members of the editorial board; Mr. Toby Leslie, Dr. Mashuqur Rahman, Dr. Mohamad Nadir, Dr. Waqar Butt and Dr. Hamida Hameed for their time and contribution to the Journal. Furthermore, sincer appreciation goes to Dr. Khawja Mir Islam Sayed, Dr. Mohammad Tawab Saljuqi, Dr. Hafiz Rasoli and Dr. Jawad Mofleh from Afghan Public Health Institute for their constructive feedbacks on the first draft of the Journal. In addition, I am obliged to Vestergaard Frandsen for the financial support to publish the first issue of the Afghanistan Annual Malaria Journal.

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Foreword by His Excellency the Minister of Public Health:

Improving healthcare is a priority for the Government of Afghanistan. In the last seven years, many gains have been made in this sector. The Basic Package of Health Services provides a minimum standard of healthcare to almost all of the Afghan population; mother and child health services have seen huge expansion, and health indicators in Afghanistan are improving.

Malaria control is one area where significant progress has been made. Through the basic package of health services, more people than ever have access to diagnosis and treatment and one of Asia's largest Insecticide Treated Net programs is underway with more than one million nets distributed in the last two years. Building of national institutions for malaria control continues, with the National Malaria and Leishmaniasis Control Programme continuing to gain greater capacity and taking on a strong leadership role.

Despite these gains there is still much work to do. Emerging threats of drug resistance, insecticide resistance and lack of access to treatment of vivax malaria with primaquine are all new priorities. Under funding from the Global Fund for AIDS, TB and Malaria Insecticide Treated Net coverage is set to increase. But this progress should not be let to slow us down. The call for elimination of malaria as a long term aim requires even greater effort to control the disease.

This “Afghanistan Annual Malaria Journal” is the first of its type in our recent history. I hope that it will serve as a reference for those concerned with malaria control and help to maintain an allertness of the threat that malaria poses for Afghanistan.

I take this opportunity, on World Malaria Day 2009, to congratulate all who have assisted in controlling malaria in Afghanistan on their acheivements, but also to sound a warning that we must maintain the pressure on the disease and not loose the momentum that we have gained in the last 7 years of progress.

Dr. Sayed Mohammed Fatimie,
Minister of Public Health,
Islamic Republic of Afghanistan

April 25th 2009
Editorial:

Malaria kills over one million men, women and children, most of them in sub-Saharan Africa. In some African countries it is the principal cause of death, ahead even of AIDS. Children are the most severely affected. They are at special risk because they have not had time to acquire the level of partial immunity that can keep the disease from becoming life-threatening. As a result, 1,000 children, mostly from poor rural areas, die of malaria every day.

Greatly compounding the problems of illness and death caused by malaria is the growing ineffectiveness of the traditional medications that are still used in a number of the most seriously affected countries. Both chloroquine and sulfadoxine-pyrimethamine (commonly called SP) have long been employed together as the first line of treatment. But increasing levels of resistance have rendered both chloroquine and SP virtually useless in many parts of the world in treating Plasmodium falciparum malaria. Over the past decade, however, ACT an artemisinin-based combination therapy has emerged as a new form of treatment that has proven effective in countries particularly hard hit by epidemics of malaria. When used in conjunction with other anti-malarials developed over the past three decades, it has proven successful. ACT has been used with impressive results in a number of countries. As of now, however, only half a dozen African countries have actively promoted the switch from the earlier, largely ineffective therapies to the artemisinin-based protocol. A primary reason for this is the expense. While chloroquine costs only pennies per patient, ACT costs an average of $1.50 or more per adult and 40 cents per child. Small though these sums may seem, for desperately poor families they can represent insurmountable barriers, unless rich countries contribute more to funding organizations like the Global Fund to Fight AIDS, Tuberculosis and Malaria. The Gates Foundation, a major donor in the fight against malaria, has estimated that $2 billion would be needed to control the disease.

In Afghanistan, malaria is one of the major public health problems. It has been almost effectively controlled in the country in 1970s. However, during last three decades of social disruption and civil war the burden of disease gradually increased and it spreads to the areas where it was almost eliminated.

After the establishment of interim government in 2001, National Malaria Control Program was reorganized and new strategies; prompt diagnosis and effective treatment, integrated vector management, behavioural change communication and health system strengthening, were adopted for the malaria control in the country. A National Strategic Plan was developed for the year 2006-2010 and remarkable amount of financial resources were provided by Global Fund under Round 5 for malaria control in Afghanistan. As a result of effective control measures significant decline (95% and 76.6% decline in PF and PV cases respectively) was documented during 2002-2008. Only during 2008, 29% and 3% reduction in PF and PV cases have
been reported respectively. A review and gap analysis of the National Malaria Control Program was conducted in early 2008. Based on the gaps identified a new Strategic Plan for the years 2008-2013 was developed. To fill the identified gaps additional resources (78 million Euros) were committed by Global Fund for the next five years.

Effective use of the available tools; ACT and LLINs, could further reduce the infection rate. According to the survey conducted recently less than 20 percent of the population live in high risk areas has access to nets. It is planned to distribute more than 6 million LLINs in next five years, which will cover more than 80% of the population at risk. ACT will be provided to all confirmed PF cases. However, the confirmation of all malaria cases is still a major barrier and challenge for the effective treatment. As lab facility is not available in Basic Health Centres, where presumptive treatment is provided to many suspected cases.

This review of malaria in Afghanistan for the year 2008 is aimed at all those involved in healthcare delivery and development. It contains reviews of the current situation in Afghanistan, challenges faced in control of disease, the future direction of malaria control and provides an opportunity to describe the research that has recently been undertaken in the country. The editorial board hopes, as I do, that this will provide a useful reference for those involved in healthcare delivery as we strive to maintain pressure on this insidious disease.

Najibullah Safi, MD, MSc. HPM, DMPPM
Manager, National Malaria and Leishmaniasis Control Program, Kabul, Afghanistan. April 2009
NMLCP Annual Report, 2008:
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Executive Summary

Malaria is one of the major public health problems in Afghanistan. According to WHO report; Afghanistan has the second highest burden of malaria in EMRO and the forth worldwide outside Africa. Malaria occurs at altitudes below 2,000 metres above sea level and is most prevalent in snow-fed river valleys and areas used for growing rice. Transmission is seasonal from June to November, with negligible transmission occurring between December and April.

According to historical data on malaria morbidity, climate and attitude the entire country is divided into three strata. First stratum includes high risk areas, second stratum is considered as a low risk area, while third stratum has less potential for malaria transmission. The risk of malaria transmission is not homogeneous in provinces of each stratum.

Leishmaniasis is another major public health problem in Afghanistan; cutaneous Leishmaniasis is more prevalent, however, sporadic cases of visceral leishmaniasis have been reported from northeast, southern and northwest provinces in recent years.

National Malaria and Leishmaniasis Control Program had significant achievements in 2008 as follows:

- Development of Strategic Plan for the years 2008-2013
- Development of teaching guidelines for medical doctors, lab technicians, mid level health workers and community health workers
- Construction of a power station in NMLCP
- Establishment of 30 microscopic centers in Laghman, Baghlan and Takhar provinces
- Provision of US$ 7,785,075 by Global Fund for malaria control in 14 high risk provinces
- Approval of a total US$ 90,000,000 by various donors over next 5 years for malaria control
- Several studies including monitoring the efficacy of anti-malarial drugs, national representative malaria indicator survey, home based management of malaria, and joint research project between Afghanistan, Iran and Pakistan have been completed
- Training: Over all 758 participants from Ministry of Public Health, NGOs and for profit private sector completed the offered courses
- Information, Education and Communication: 200,000 notebook for students, 200,000 posters and 200,000 brochures have been distributed in 14 malaria high risk provinces
- Malaria Prevention: more than one million LLINs have been distributed in high risk provinces

Introduction:

Malaria is one of the major public health problems in Afghanistan. According to WHO report; Afghanistan has the second highest burden of malaria in EMRO and the forth worldwide outside Africa.
Malaria occurs at altitudes below 2,000 metres above the sea level and is most prevalent in snow-fed river valleys and areas used for rice growing. Transmission is seasonal from June to November, with negligible transmission occurring between December and April. However, many *Plasmodium vivax* infections relapse during the spring season and this may give rise to a *vivax* peak around July. The *Plasmodium falciparum* peak is in October, a few months after the summer peak of *P. vivax*. The seasonality and relative low prevalence of malaria (e.g. about 10% in endemic areas) results in a population only partly immune to malaria, with children and teenagers carrying most of the burden. Approximately 14 million people live in malaria endemic provinces and are exposed to high risk of the disease. In 2008, 19.87 cases of malaria per 1000 population (467123) were reported. This shows 0.87 % increase in number of cases as compared to 2007. This increase is due to the expanded coverage of public health care system and improvement in reporting. In 2008, 1675 health facilities reported malaria cases as compared to 1252 in 2007 (33.8% increase in number of health facilities). However, WHO estimate 0.6 million cases per year\(^1\).

**Stratification of malaria in Afghanistan:**

Major determinants of malaria transmission in Afghanistan are altitude and agricultural practices (rice cultivation). Based on available information about malaria transmission, WHO and MoPH divided the entire country into three strata. First stratum includes high risk areas, second stratum is considered as a low risk area, while third stratum has less potential for malaria transmission. The risk of malaria transmission is not homogeneous in provinces of each stratum.

First stratum with medium to high transmission risk incorporates Badakhshan, Badghes, Balkh, Faryab, Herat, Helmand, Kandahar, Khost, Kunar, Kunduz, Laghman, Nangarhar and Takhar provinces. Second stratum which is consider as low risk areas comprises of Daikundi, Farah, Jauzjan, Kabul, Kapisa, Logar, Nimruz, Oruzgan, Paktia, Paktika, Parwan, Samangan, Sar-e-pul, Wardak and Zabul provinces. Central highlands of Baghlan, Bamyan, Ghazni and Ghor have very little potential for malaria transmission, which is considered as third stratum.

\(^1\) World Malaria Report 2008
Diagnosis and treatment of malaria is integrated into Basic Package of Health Services (BPHS). National Malaria and Leishmaniasis Control Program is mainly responsible for developing National Policies and Guidelines for the control of both diseases. In addition, close monitoring of the program implementation, capacity building, ensuring the quality of services, preparation of teaching materials and guidelines, operational research, rising public awareness and timely detection and control of epidemics are among the major responsibilities of the National Program.

Anopheles superpictus, A. culicifacies, A. Stephensi, A. hycranus, A. pulcherimus and A. fluviatilis are the main vectors of malaria in Afghanistan.
Leishmaniasis is another major public health problem in Afghanistan; Cutaneous Leishmaniasis is more prevalent, however, sporadic cases of visceral leishmaniasis have been reported from northeast, southern and northwest provinces in recent years. According to the survey conducted in 2006 it is estimated that there is around 70,000 cases of cutaneous leishmaniasis only in Kabul and 300,000 all over the country.

Treatment of cutaneous Leishmaniasis is integrated in BPHS at the District Hospital level. Though, anti-leishmanial drugs are not available at District Hospital yet. Entomological studies conducted in Kabul in 2006-2008 shows that the main vectors of cutaneous Leishmaniasis are *Phlebotomus major*, *P. sergenti*, *P. bergeroti* and *P. papatasi*.

According to the Malaria National Treatment Guideline, suspected malaria cases are treated with Chloroquine and Fansidar, confirm PV cases with Chloroquine and confirm PF cases with ACT. LLIN is recommended as a main tool by National Malaria Strategic Plan for malaria prevention and vector control in Afghanistan.
Main achievements in 2008

Main achievements of the National Malaria and Leishmaniasis Control Program in 2008 are as follows:

1. **Policy and Plan:** following plans and strategies have been developed in 2008
   - Strategic Plan for the years 2008-2013
   - Development of teaching guidelines for medical doctors, lab technicians, mid level health workers and community health workers

2. **Construction of infrastructure:**
   - A new Power Station and Parking were constructed in NMLCP

3. **Diagnosis:**
   - 30 microscopic centers were established in Laghman, Baghlan and Takhar provinces

4. **Resource Mobilization:**
   - During 2008 US$ 7,785,075 was provided by Global Fund for malaria control in 14 high risk provinces
   - Global Fund is committed to provide US$ 15,043,320 over next three years for malaria control in 14 high risk provinces under second phase of Round 5 project
   - Global Fund approved Malaria/HSS proposal submitted in Round 8. The total amount of Euro 55,397,259 is committed over next five years
   - To strengthening malaria control activities in Kandahar Province a project proposal (US$ 4Million) in collaboration with WHO has been developed and submitted to CIDA and French government. Out of which French government approved 1 million Euro. The project will start in the first quarter of 2009
   - US$ 1.7 million was approved by USAID for the capacity building of the program and establishment of 71 lab in BHCs of Baghlan, Takhar and Badakhshan provinces

5. **Research:**
   - Monitoring the efficacy of anti-malarial drugs in three sentinel sites in Nangarhar, Takhar and Faryab; results confirm that chloroquine is still effective for the treatment of PV and ACT for PF
   - National representative Malaria Indicator Survey was conducted in November 2008
   - The project of Home Based Management of Malaria has been completed in Nangarhar and Kunduz Provinces
   - Joint research project between Afghanistan, Iran and Pakistan, funded by TDR/WHO, on sub species of PV has been completed. The final report of the study will be available shortly
   - Leishmaniasis vector surveillance in Kabul city has been started with financial support from NAMRU-3. Preliminary reports substantiate that the main vectors for the cutaneous Leishmaniasis are P. major, P. sergenti, P. bergeroti and P. papatasi

6. **Surveillance:** In order to obtained data on number of PF cases treated with ACT
new reporting forms were introduced in 2008.

7. **Training**: In order to build the capacity of the staff and enhance program performance; comprehensive training programs were designed for health professionals including medical doctors, nurses, lab technicians, mid level health care providers and community health works of public and private sectors at the National and Provincial level. Over all 758 participants from Ministry of Public Health, NGOs and for profit private sector completed the offered courses. Moreover, with financial support from WHO, three medical doctors attend a Diploma Course on Malaria Program Planning and Management in Regional Training Center of the WHO in Bandar Abbas, Iran. In addition, two senior lab technicians completed a certificate course in quality assurance in Oman and one entomologist is under training for Master degree in entomology in the University of Khartoum in Sudan.

8. **Information, Education and Communication**: In order to enhance the community awareness regarding malaria prevention and timely treatment 200,000 notebook for students, 200,000 posters and 200,000 brochures have been distributed in 14 malaria high risk provinces.

9. **Malaria Prevention**: In order to prevent malaria transmission especially in high risk groups more than one million LLINs have been distributed in Nangarhar, Laghman, Kunar, Khost, Baghlan, Kunduz, Takhar, Balkh, Faryab and Badakhshan provinces in 2008. In addition around 80,000 bed nets have been re-treated and comprehensive awareness campaign was carried out in stratum one Provinces. As a result of a wide range of preventive measures over the last few year significant reductions occurred in the burden of malaria (Figure 1, 2, 3).

![Figure 1: Trend of PV Malaria 2002-2008](image1.png)

![Figure 2: Trend of PF Malaria 2002-2008](image2.png)
In the 1990s, Pf cases composed 20% of reported cases. Fortunately due to effective control measures this proportion reduced to 1% in 2008 (Figure 4).

10. Control of Malaria Epidemics:

The only outbreak in Afghanistan was reported from Faizabad, Badakhshan in September 2008. The outbreak was detected in the first week of its occurrence. Through sensible and effective response of the program and Partners; HN-TPO, CAF, WHO and Provincial Health Directorate the outbreak was controlled in two weeks. Active surveillance was established and totally 131 cases of PF and 61 cases of PV were registered. Fortunately there was no mortality.

Challenges:

- Insecurity particularly in southern part of the country
- Inadequate financial resources
- Inadequate number of qualified staff
- Lack of motivation
- Poor coordination among stakeholders
- Gratuitous interference
- Time consuming bureaucracy
- Centralized system of decision making
Progress and Challenges to Malaria Control in Afghanistan

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Abstract:

Malaria in Afghanistan, as in most of South Asia, is the product of two coexistent species, Plasmodium falciparum and P. vivax. Transmission of disease is relatively low, and the predominant species is P. vivax, causing 80-90% of cases. In the most endemic areas, incidence is estimated at 10-100 per 1000 person years for vivax malaria and 1-10 per 1000 person years for falciparum malaria.

Treatment for the two species differs because vivax remains susceptible to chloroquine, while falciparum malaria has developed unsupportable levels of resistance. Falciparum malaria, if confirmed is treated with the more expensive sulfadoxine-pyrimethamine with artemether (SP/AS). Malaria incidence is sufficiently low that the majority of cases suspected to have malaria by clinical evaluation are negative on blood examination (slide positivity rate is 15-30% in most areas). In the absence of diagnosis, the present policy is to treat all suspected cases with SP and chloroquine. In many areas, diagnosis is unavailable or unreliable and therefore many patients are inappropriately treated. Delivery of diagnostics is therefore crucial. Delivery of personal protection is by insecticide treated nets, and there has been a rapid rise in coverage. Perhaps the biggest barrier to effective malaria treatment in this region, where vivax malaria predominates, is the absence of effective anti-relapse therapy that can provide radical cure. Primaquine use is unavailable because of the presence of G6PD deficiency in the population.

There are numerous challenges to providing sufficient pressure on malaria to maintain control in South Asia, amongst the most important of which is the continued socio-political instability in the region. If the goal of eradication or elimination of malaria is to be achieved, this prerequisite is required.

Introduction:

Malaria control remains a challenge in limited resource settings, despite substantial assistance from multilateral donors such as the Global Fund for AIDS, TB and Malaria (GFATM) and increased political will at national and international level (Snow et al, 2008). Although most resources focus on areas of sub-Saharan Africa where transmission is most intense and the majority of deaths occur, considerably more people live in areas at risk of transmission outside this area (Guerra et al, 2008a). Most malaria endemic areas outside Africa are characterised by low to moderate transmission and mixed endemicity with two coexistent species, Plasmodium falciparum and P. vivax (Guerra et al 2008b).

In South and Central Asia, the force of malaria transmission is relatively low, although widely
variable. The majority of malaria morbidity is attributable to vivax malaria which, although considered relatively benign in terms of mortality, contributes significantly to the burden of disease in endemic areas (Mendis et al, 2001). A relatively lower proportion is caused by *P. falciparum*.

The low and unstable transmission of malaria makes these areas attractive possibilities for effective control or local or regional elimination of disease. The challenges are nonetheless daunting. Mixed endemicity, where treatment for the two species differs, presents the challenge of access to and successful targeting of appropriate treatment; the scaling up of control and elimination programs on a national and regional scale depends on socio-political stability – a challenge that goes well beyond the realm of malaria and health development; all countries in South Asia are both endemic for malaria and suffer from low-moderate intensity conflict and chronic political instability.

Afghanistan is one country in South Asia whose recent history is well known to most observers of current affairs. Characterised by multi-level instability, poverty and years of war damage to infrastructure, Afghanistan is attempting to reconstruct. Gains in the healthcare system have been made with gains in coverage being rapid (Ameli and Newbrander 2008). Half of the population live in areas of malaria endemicity (Brooker et al, 2006).

This article aims to present a review of current knowledge relevant to malaria control in Afghanistan and the wider region. It describes efforts to control malaria, the challenges faced, and the future direction of efforts to control disease. Sources used consist of published and unpublished (grey-) literature accessible through a variety of sources, namely: the published peer-reviewed literature (MEDLINE), internal routine data, national and regional programme reports and policies.

**The Context of Afghanistan:**

Afghanistan has suffered chronic conflict for nearly three decades. It constitutes a long-term complex emergency characterised by both environmental and manmade disasters. During years of protracted conflict and drought, millions of people sought refuge in neighbouring Pakistan and Iran. Many have now repatriated (UNHCR, 2008). Efforts are now underway to rebuild infrastructure, despite re-emergent security problems.

Health sector reconstruction in Afghanistan has made considerable progress since the fall of the Taliban in 2002, and despite ongoing security challenges. Since this time, international donors and the Government of Afghanistan have implemented two major multilateral initiatives to improve both coverage and quality of healthcare. The Basic Package of Health Services (BPHS) and the Essential Program of Hospital Service (EPHS) have absorbed large amounts of donor support and achieved considerable amounts in terms of coverage and improved access to health care.
The BPHS is a primary healthcare programme which covers community level to district level health services (Figure 1.1). It provides a minimum standard of healthcare which, on paper, is available to every Afghan. The program is designed to cover the majority of the population of the country and to provide preventative as well as curative services. It conforms to a well defined pyramidal structure from Health-Posts (HP) at community level, through Basic Health Centres (BHC), through the Comprehensive Health Centre (CHC) and up to District Hospital Level. The BPHS also provides other services, such as the Extended Program of Immunization (EPI), and community initiatives, such as midwifery and mental health. The EPHS governs hospital level care from district hospital level, provincial and regional hospitals as well as specialist and teaching hospitals. The private sector also plays an important role in health care delivery with estimates of usage ranging from 75-45% using a variety of methods. Out of pocket expenditure in the private sector is high and remains constant when stratified by socio-economic status (Seinhardt et al, 2009; HN-TPO, 2008 unpublished consultancy report).

Since the implementation of the BPHS and latterly, the EPHS, malaria control has shifted from a largely vertical programme to a semi-integrated approach (Kolaczinski et al, 2004). Diagnosis and treatment are provided through the general health services, public health education and distribution of insecticide treated nets are partially integrated, with malaria specific training and research conducted by a number of agencies led by the National Malaria and Leishmaniasis Control Programme.

Malaria Control in Afghanistan is governed by the Strategic Plan for Malaria Control, recently updated to span 2008-2012. The program is
led by the National Malaria and Leishmaniasis Control Program, a sub-division of the Department of PHC and Preventative Medicine of the Ministry of Public Health. It is supported by a number of stakeholders including WHO and other UN agencies and NGOs (Kolaczinski et al, 2005). A Vector Borne Disease Task Force acts as the primary coordination mechanism at central level which has a specific mandate to coordinate efforts and review and update policy. The programme is built on a tradition of evidence based operations, with research playing a pivotal role in policy development. At provincial and local level, Malaria Reference Centres situated in 18 provinces provide input into local activities.

Donors to the BPHS and EPHS (most prominently USAID, the European Commission and World Bank) shoulder considerable proportions of the cost of malaria control, through human resources, and implementation of care through clinics and hospitals. The Global Fund for AIDS, TB and Malaria provides almost all of the remaining funding for malaria programming in Afghanistan. The current Round 5 grant (GFATM, 2006) provides funding for insecticide treated nets, supporting salaries for Ministry of Public Health staff, training, enhanced diagnosis, infrastructure and operational research. Other small grants assist in operational research, for example, the WHO/UNDP Special Programme for Research in Tropical Diseases.

Malaria Epidemiology:

Malaria in the region is typical of most of Southern and Western Asia and can be summarised as hypo-endemic unstable transmission. Transmission is seasonally and geographically constrained with mixed endemcity. *Plasmodium vivax* predominates, accounting for 70-90% of cases and an incidence of approximately 10-100 per thousand per year in the most endemic areas. The remainder of cases are caused by *P. falciparum* with approximate annual incidence of <1-10 per thousand per year (Rowland et al. 1994, Rowland et al. 1999, unpublished clinic data).

*P. vivax* incidence varies throughout the year, with a peak in the summer months, generally assumed to be caused by relapses from infections transmitted in the previous year. *P. falciparum* cases are seen over the winter months, usually from August to December (Fox & Strickland, 1989, Rowland et al 2002). Geographically, malaria is confined to areas below 2000m above sea level and is limited by environmental and human factors (Brooker et al, 2006) (figure 1.2). This has led to the classification of three risk strata in Afghanistan, which enables targeting of resources to control disease. Most areas endemic for malaria are also those with the highest population densities, being areas outside the mountains, close to rivers and in irrigated areas.
Of the total population of approximately 28 million people, there are an estimated 11 million living in areas of high risk of transmission (strata 1 districts), with a further 3.5 million living in areas of moderate transmission risk (strata 2). Annually, through the public health information system, approximately 300,000 cases are reported. This number of cases is certainly an underestimate of the total case load, since private sector use is frequent (Kolaczinski et al 200, Leslie et al, 2008, unpublished).

All age groups up to the age of 30 years are at approximately equal risk of developing malaria, probably due to the lack of development of functional immunity in the population (Suleman, 1988, unpublished observations). In the most endemic areas of the country the attributable fraction of malaria to febrile illness at the clinic level ranges from 10-30% based on slide positivity rates. A negative association exists between household level fever and use of ITNs (Leslie et al, 2008 unpublished) in endemic areas, suggesting that malaria contributes significantly to the spectrum of febrile illnesses at community level. Recent studies suggest that malaria is not a considerable contributor to anaemia in pregnant women, and nor is pregnancy a risk factor for disease (HN-TPO, 2004 unpublished). However, this does not reduce the severity of morbidity in pregnant women and their offspring.

The majority of malaria episodes are caused by *P. vivax* infections. The ability of this species to form hypnozoites in the liver contributes to its stability. Even with effective treatment for acute episodes, one initial infection may lead to up to 10 or more subsequent episodes (Leslie et al, 2004; Leslie et al, 2008). Not only does this cause excess morbidity, but also acts as a reservoir of disease. It is this reservoir which allows the disease to continue its transmission cycle and reduces the efficiency of insecticide treated nets as a control tool; infected persons may develop further episodes, even if they
regularly use an ITN (Rowland et al, ITN Paper).

Epidemics of falciparum malaria have been reported from Afghanistan, and epidemic preparedness and response guidelines are functional. Recent epidemics have occurred at high altitude (Rowland et al, BAMYAN) and as a consequence of conflict, drought and substandard drugs.

The epidemiology of malaria has been affected by the many years of war and social upheaval in the region. During the late 1970s and early 1980s it is estimated that around 1/3 of the population of Afghanistan (6.2 million) fled to neighbouring Iran and Pakistan to escape the violence (Rowland et al 2002). Around 3 million of these refugees settled along the border area between Pakistan and Afghanistan in 317 refugee camps. Against this backdrop of population displacement and with the advent of chloroquine resistance (Robinson 1984) came an increase in the incidence of malaria in Pakistan (Suleman 1988). The situation in the 1980’s and 1990’s, with mass people movement, is now occurring in the opposite direction. Repatriation of approximately 4.1 million refugees has been ongoing since 2002 (UNHCR, 2008). The impact of this movement on malaria in Afghanistan has yet to fully emerge, but given the current rapid expansion of control, any impact is likely to be tempered. Specific targeting of returning refugees with control tools and public health information has been conducted for the last two years. This includes provision of ITNs to returning families.

**Control of Disease:**

Control of malaria in Afghanistan is based on horizontal programming, providing diagnostic and curative services with elements of verticality. The control strategy (National Malaria Strategic Plan) is provided for by funding from the GFATM. The programme focuses on provision of diagnosis, effective treatment, personal protection through ITNs, vector control, and institutional and technical support. The programme has a strong tradition of evidence based interventions and routinely conducts operational research projects which have influenced policies on malaria control.

**Diagnosis:**

Diagnostic standards are a concern for malaria control in low transmission areas and especially where species coexist; differentiation of species is an important aspect of case management; due to drug resistant falciparum malaria, treatments for the two diseases differ. The challenge is to provide diagnostic services to the majority of cases in order to a) treat malaria appropriately and b) to treat non-malarial febrile illness appropriately. There is a mounting body of evidence (primarily from Africa) that simply inserting diagnostic services into the health system has a limited effect on treatment of febrile illness, while increasing costs considerably (Reyburn et al, 2007; Chandler et al, 2007; Lubell et al, 2008).
The picture in Asia is less clear where less data exists. There are a number of differences from the African setting; co-endemicity of species and in most areas, much lower transmission levels (Whitty et al, 2008).

In Afghanistan and Pakistan, diagnosis is primarily provided through three channels; microscopy at the clinic or hospital level; clinical assessment by health workers or informally in the household; and in the private sector.

In the formal government sector, diagnostic services are currently not available in most facilities at the two lowest levels of the structure (Health Post and Basic Health Centre) (figure 1.1). Diagnosis in areas where most cases occur (the periphery) is thus most likely to be by clinical means alone - without laboratory confirmation. Clinical diagnosis, especially in areas of low-moderate transmission, is notoriously inaccurate and leads to over treatment of malaria in non-malarious febrile cases and under treatment in febrile cases which are actually caused by malaria (Whitty et al, 2008). At higher levels of the health service (CHC and above), diagnosis is currently by microscopy. Microscopy which can accurately identify to the species level requires a high degree of training, and adequate resources including microscopes and reagents of high quality. In addition, microscopy looses a significant amount of its cost-effectiveness where patient through-put is low (Shillcutt et al, 2008). This makes it an unattractive option for filling the gaps at the lower end of the health service where patient throughput is low.

Rapid diagnostic tests (RDT) are currently seen as the most effective way of addressing this problem, but only if certain criteria are met. RDT do have several advantages over microscopy, especially in areas where patient through-put is low when they are more cost effective than diagnostic alternatives (Shillcutt et al, 2008). They are also easy to use, and provide a visual diagnosis for the patient. The technology for species differentiation is developing but may not be stable at adverse temperatures and humidity. RDT may also suffer from lack of confidence in both provider and patient who may not believe the result, especially if it is negative (Chandler et al, 2008). This factor may be sufficiently important that it makes no difference (in terms of cost or clinical outcome) whether the RDT is used or not if all febrile illness where a diagnosis is treated as malaria regardless of the test result (Whitty et al, 2008). Therefore, RDT implementation requires generation of effectiveness data and careful consideration before national or regional level roll-out.

Efforts to improve diagnostic standards in the public sector may have limited effect if the private sector provides a high proportion of care. Usage of the private sector for healthcare has been variably estimated at between 75% and 45% (Steinhardt et al, 2009; HN-TPO, 2008 unpublished); by all estimates, a considerable proportion use this
sector, although there is currently no data on the accuracy of diagnosis or adherence to the result. Currently, in the private sector in endemic areas, most providers (laboratories) have malaria diagnostic services (HN-TPO, 2008 unpublished). Almost all provide microscopy as opposed to RDT. Usage of the private sector for diagnosis and treatment of malaria can be assumed to be high, which may undermine efforts to strengthen the public sector unless included in the overall malaria control plan.

Home based diagnosis and treatment is as yet unquantified, but is not thought to be high; recent studies have shown that >90% of febrile patients seek treatment in the public or private sector (Steinhardt et al, 2009; HN-TPO, 2008 unpublished).

Effective treatment:
Chloroquine (CQ) has been the mainstay of malaria therapy in Pakistan and Afghanistan for decades and was used to treat both species effectively. The advent of CQ resistant falciparum malaria in the 1980's (Delphini 1989; Robinson 1984) and its further spread (Shah et al 1997, Rab et al 2001, Rowland et al 1997b) increased the proportion of malaria caused by falciparum malaria. By 2001, in Eastern Afghanistan, failure rates with CQ were unsupportable with only 33% of patients successfully treated using in vivo surveys (Durrani et al, 2005).

Fansidar remains relatively effective against falciparum malaria, with recently reported failure rates of 5-23% (Ezard et al 2004, Graham et al, In Press), although levels of resistance were reported in 1997 (Rowland et al 1997b). Trials of a variety of artemisinin combination therapies (ACT) (Durrani et al, 2005; Kolaczinski et al, In Press) have been conducted and have informed policy makers such that SP/AS is now standard treatment for laboratory confirmed falciparum malaria in most of the EMRO region.

CQ still remains highly effective against acute episodes of vivax malaria (Leslie et al 2004, Leslie et al, 2007, Leslie et al, 2008) despite a worrying increase in reports of resistance from other parts of Asia, East Africa (Ethiopia), and South America (Lee et al, 2009; Teka et al, 2008; de Santo Filho et al, 2007). The common assumption that vivax malaria is intrinsically resistant to antifolate drugs (fansidar) has recently been challenged by evidence from Pakistan and Afghanistan (Leslie et al, 2007) where a trial concluded that this class of drugs is safe and effective for treatment of acute vivax. This contrasts with other areas of Asia, where low sensitivity has been reported in smaller studies (e.g. Pukittayakamee et al, 2000; Young & Burgess, 1959). ACT is also effective against vivax malaria (Kolaczinski et al, 2007)

The radical cure of vivax malaria, using primaquine or other anti-hynozoite drugs, still presents considerable challenges. Although effective when given as the standard 14 day course, and a recently tested 8 week regimen, primaquine cannot be readily used in the population (Rowland & Durrani, 1996, Leslie et al. 2004; Leslie et al
2008). The high prevalence of the common enzymopathy glucose 6 phosphate dehydrogenase (G6PD) deficiency precludes its use because, in the presence of primaquine, G6PD deficiency can cause clinically significant and occasionally severe haemolytic anemia (Bouma et al 1995, Leslie et al 2004). Since G6PD testing is not readily available, anti-relapse therapy cannot be made widely accessible to most populations at risk of vivax malaria. The risk to benefit ratio is not seen as favourable.

The national treatment guidelines call for a combination of CQ/SP for suspected malaria (i.e. where there is no laboratory diagnosis), CQ alone for confirmed vivax malaria, and SP/AS for confirmed falciparum malaria. Severe malaria is treated with artemether or quinine.

The challenge of providing treatment for malaria in Afghanistan is not so much the effectiveness of the drugs, but more their delivery to those who need them. This is intertwined with the delivery of diagnostics. Currently, most cases are treated presumptively with SP and CQ, since diagnostic services are not available. Those treated with this regimen are also supposed to be referred for diagnosis to higher levels of the health service, although there has been no assessment of the frequency with which referral is made, nor the success rate of the referral. It is suspected, and there is anecdotal evidence to support this, that both rates of referral and adherence to referral are low. Although the majority of patients with parasites are treated with effective drugs, the current strategy has a number of shortcomings; firstly, many people who receive treatment do not have malaria and secondly, those who have falciparum malaria are treated with SP monotherapy (since the efficacy of CQ can be discounted). This threatens the combination therapy of SP/AS, since use of SP monotherapy over even a relatively short period of time is likely to precipitate the formation of resistance (Plowe, 2008) as its use places the parasites under selection pressure. At the same time, if SP/AS becomes more widely available the efficacy of the AS component may mask the increased tolerance to SP, essentially leading to treatment with AS monotherapy. Countering this threat requires both in vivo and in vitro monitoring, which are currently being conducted. In vitro monitoring is being conducted to examine a baseline of known drug resistance alleles, whilst routine monitoring of efficacy is being conducted in three sites using a standard WHO protocol.

Drug supply and delivery to clinics is also a component of effective treatment which goes beyond the realm of drug effectiveness. Currently, very few clinics (even those with diagnostic services) have artesunate available, so it can be concluded that uptake of the policy which was formulated in 2003 has been suboptimal. Artesunate has yet to become widely available in the private sector with the most recent estimates being that <5% of private pharmacies stock it.
Substandard and counterfeit drugs are currently a key concern (Newton et al, 2009), and have been detected in large numbers in both Southeast Asia and East Africa (Dondorp et al, 2004; Atemnkeng et al, 2007). Neither Afghanistan nor Pakistan have drug safety infrastructure and both have a largely unregulated pharmaceuticals market. Pakistan also has an extensive, though unregulated, pharmaceuticals industry. Substandard drugs have been detected in the region.

The challenge of providing suitable and effective treatments is therefore twofold. The first is intertwined with delivery of diagnostics at the periphery and the second is to ensure that drugs are available to those who need it in ensuring that those with and without malaria receive appropriate treatment. This involves changing perceptions and practice of both users and providers for the treatment of non-specific febrile illness and ensuring delivery of drugs to outlets.

**Personal Protection and Vector Control:**
As in most of the world, the mainstay of vector control and personal protection in the region is through use of insecticide treated nets. Locally conducted household randomised trials of ITNs have shown their effectiveness (Rowland et al, 1996; Rowland et al, 2002), although the effect is considerably less against vivax malaria because of the hypnozoite reservoir causing relapse episodes without the bite of an infective mosquito.

Since the beginning of the ITN programme, in the early 1990’s, distribution has expanded. Most recently, with funding from the Global Fund for AIDS, TB and Malaria, Afghanistan has received more than 1.5 million ITN and similar numbers are due to be delivered to Pakistan.

Mechanisms of distribution have, thus far, relied on the provision of nets primarily through social marketing (Kolaczinski at al, 2004). Although associated with socio-economic inequity (Rowland et al 2002, Howard et al, 2003), coverage has increased.

Other vector control tools have been tested locally, and these include tent spraying (more applicable to acute emergencies) (Hewitt et al 1995, Graham et al 2002), treated clothing or bedding (Rowland et al 1999), and livestock sponging which is effective against zoophilic vectors (Hewitt and Rowland 1999, Rowland et al 2001). Indoor residual spraying is also effective and a key component of epidemic control (Rowland et al 1994; Rowland et al 1997a).

Although impressive progress has been made in scaling up ITN distribution, there are a number of challenges remaining. The sustainability of ITN programs is threatened by free distribution, reliant on donors and sustainable programming is likely to be needed in the not-too-distant future. However, access to the Global Fund’s Rolling Continuation Grant could provide long-term assistance in ITN delivery. Vector control could also benefit from a bolder approach to
Integrated Vector Management, which should include application of insecticide in animal sheds, where adult anopheles species are most abundant.

**Surveillance:**
Disease surveillance is conducted through different channels and through different methodologies. Primarily, malaria surveillance is conducted through the national system of monitoring; the Health Management and Information System (HMIS). This system monitors a number of diseases and health indicators through the BPHS and EPHS. There are a number of shortcomings to this system, however. The system lacks timeliness, reflects the diagnostic facilities in place (resulting in reporting primarily of suspected cases) and relies on accurate reporting from hundreds of facilities. A secondary channel is through the use of twenty-two sentinel sites situated across the county at 50-100 km intervals. These are situated in facilities which have reinforced diagnostics (microscopy) and report to the centre on a weekly basis. Periodic cross-sectional surveys are conducted, but are of limited use for malaria parasite surveys, since prevalence is low and transmission seasonally and geographically variable. These surveys, although relatively expensive, do have applicability for monitoring ITN coverage, conducting serological surveys, and on a local level for assessment of epidemics.

**Prospects for Elimination:**
The recent call for eradication of malaria as a long-term aim has changed the thinking of many aspects of malaria control and planning. Using currently available tools, areas outside sub-Saharan Africa can be seen as some of the most attractive propositions for elimination. The epidemiology of malaria in these regions (low-moderate transmission) means that the force of transmission could, in theory, be sufficiently reduced if the right tools are applied and sustained. This requires delivery of adequate health services, preventive measures and vector control, and in areas of vivax endemicity, more widespread application of anti-relapse therapy.

Many aspects of the feasibility of elimination or eradication rest outside the sphere of malaria control and healthcare. Sustained socio-political stability, funding and regional coordination are required. With these prerequisites lacking in most of South Asia the prospects for elimination are not good although the tools exist to perform the task.

**Conclusions:**
The challenges in reducing the burden of malaria in South Asia are many. Delivery of effective diagnosis and treatment, including anti-relapse therapy, continued expansion of ITNs, disease monitoring and programme sustainability remain key challenges to be overcome.
The key risk to malaria control in Afghanistan and the wider region is, however, the socio-political situation. The deteriorating security situation in Afghanistan and Pakistan are a considerable threat – not only does conflict restrict access to large areas at risk, it also results in population movement and a regression of development progress. It can also be seen as a barrier to donor funding since results of major investment may never be realised (Snow et al, 2008).

Despite significant investment by international donors, Ministry of Public Health and partner organisations and the gains in control made during the post-Taliban era, the prospect for continued effectiveness in malaria control is far from assured.

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Malaria Elimination in the WHO Eastern Mediterranean Region


Abstract:

Malaria elimination can be expected to bring substantial benefits, among them contribution to improvement of the overall socioeconomic situation and living standards of the population, and to strengthening of the health system. In the Eastern Mediterranean Region, it is technically possible to eliminate malaria and end the fight against this disease considering the level of transmission, the availability of new tools for diagnosis, treatment and prevention, and the availability of financial resources from the Global Fund to Fight AIDS, Tuberculosis and Malaria and other sources.

Introduction:

Epidemiological situation

An estimated 350–500 million clinical malaria episodes occur annually. More than 1 million deaths occur each year. Approximately 60% of malaria cases and more than 80% of malaria deaths occur in sub-Saharan Africa.

In Eastern Mediterranean Region around 54% of the population resides in areas at various risk of malaria transmission [country reports, 2006, unpublished]. The intensity of transmission is generally low in most areas. Comprehensive review of the community surveys conducted in malaria-endemic countries during 1985–2007 showed that in 87% of the surveys falciparum prevalence was below 10%, meaning that malaria is hypo-endemic [1]. Reported malaria cases have been gradually decreasing from 6.1 million in 2000 and 4.1 million in 2003 to 3.6 million in 2006. However, the reported figures represent only a fraction of the true incidence owing to the weakness of malaria information systems in most high-burden countries. It is estimated that approximately 10.5 million malaria episodes and 59 000 malaria-related deaths occur every year in the Region.

In some countries of the Region (Djibouti, Somalia and Sudan), falciparum malaria is the dominant species, while in Afghanistan, Islamic Republic of Iran and Pakistan, both P. falciparum and P. vivax are transmitted, with P. vivax as the predominant species. According to the malaria situation and type of programme, countries of the Region are categorized into three groups. Thirteen countries (Group 1) have eliminated local malaria transmission and are implementing programmes to prevent reintroduction. Three countries retain malaria endemicity in a few localized areas and are implementing a
malaria elimination strategy (Group 2). More than 95% of the malaria cases in the Region occur in six countries (Group 3). Sudan alone accounts for almost 50% of the total regional burden of malaria (Figure 1).

**Malaria elimination: current global and regional interest**

In recent years, the idea of malaria elimination has gained broader acceptance. WHO headquarters organized a meeting in Tunis in 2006 [2] that put the initiatives of individual regions, mainly the Eastern Mediterranean Region and the European Region, under a global umbrella. In 2007, the World Health Assembly requested Member States (WHA60.18) to aim at reducing or interrupting malaria transmission wherever feasible. Most recently, malaria elimination was further emphasized in a global forum of the Bill and Melinda Gates Foundation [3]. In the past decade, the Eastern Mediterranean Region of WHO has demonstrated a strong interest in malaria elimination and has supported malaria elimination in areas where it was feasible, supported by a Regional Committee resolution in 1998 (EM/RC45/R.3). In 2005 the European Region of WHO endorsed malaria elimination from Europe by 2015. Many countries across several regions are currently implementing malaria elimination programmes, including Argentina, Armenia, El Salvador, Iraq, Paraguay, Turkmenistan, Republic of Korea, and Saudi Arabia.

**Why elimination now?**

Combating malaria is included in the Millennium Development Goals, specifically Goal 6 aiming to halt or reverse the spread of HIV/AIDS, malaria and other diseases. Malaria elimination can be expected to bring substantial benefits. Malaria elimination and national socioeconomic development are interdependent and mutually supportive. Malaria elimination is a key factor for improvement of the overall socioeconomic situation and living standards of the population. Achieving malaria-free status will increase economic investment and local and international tourism. Investment in malaria elimination will help other public health programmes to achieve their goals, including prevention and control of neglected tropical diseases such as leishmaniasis, Rift Valley fever, and dengue fever. Strengthening the malaria programme with a view to elimination will contribute to the strengthening of the health system in terms of increasing coverage with laboratories and treatment facilities, and strengthening surveillance, monitoring and evaluation. The immediate benefits will be to the poor and other marginalized groups, promoting equity. Once elimination is achieved, malaria control
will rely mainly on vigilance and surveillance as part of the general public health services, thus saving the huge expenses related to case treatment, insecticides and other prevention methods for other public health priorities.

In the Eastern Mediterranean Region, it is technically possible to eliminate malaria and end the fight against this disease considering the level of transmission, the availability of new tools for diagnosis, treatment and prevention, and the availability of financial resources from the Global Fund to Fight AIDS, Tuberculosis and Malaria and other sources.

The aim of this paper is to raise the awareness with regard to the current situation of malaria in the Region and the feasibility of, and prerequisites for, malaria elimination, and to propose an outline for a malaria elimination strategy.

**Progress and achievements**

Achievements have been made in many countries of the Region since 2000. The United Arab Emirates was certified as malaria-free in 2007 [4], the last locally contracted cases in Morocco and Syrian Arab Republic were recorded in 2004. There has been a significant reduction in the malaria burden in Iraq and Saudi Arabia, while the proportion of falciparum cases in the Islamic Republic of Iran decreased from 13% in 2000 to 7.5% in 2006.

A malaria elimination project was initiated in Socotra Island, Yemen, in September 2000. The impact of the project has been a real success story, with no local cases reported since 2005. The Khartoum and Gezira malaria-free initiative was launched in 2002 aiming at elimination of malaria as a public health problem. The initiative has resulted in significant reduction of the malaria burden in Khartoum State and has set an example to be followed by other States. The parasite rate in Khartoum State decreased to 0.03% in 2006, compared to 1.5% in 2001. Reduction of malaria prevalence was also noted in Gezira, from 3.17% in 2002 to 1.27% in 2007.

Implementation of the strategy of using insecticide-treated nets in high-burden countries is being scaled up. In 2007, a total of 3.4 million long-lasting insecticidal nets (LLINs) were distributed. This number was sufficient to protect a population of approximately 9 million people from vector-borne diseases, and from malaria in particular. A higher number of nets is expected to be distributed in the coming years.

All falciparum endemic countries in the Region have updated their malaria treatment policy and have included effective artemisinin combination therapies (ACTs) as first line treatment. Access to treatment is gradually increasing, through national, Global Fund and other resources. Most countries have established a functional system for early detection and rapid response to malaria epidemics. There are also indications of reduction in malaria morbidity and mortality in high-burden countries.
Current response and strategies

Regional strategic plans

In 1999, the Roll Back Malaria initiative was launched in the Eastern Mediterranean Region. All countries of the Region committed themselves to the objectives of the initiative and developed national strategies accordingly. The first regional strategic plan for Roll Back Malaria was developed in 2002 and updated in 2006 [5]. The objectives are by 2010:

1) To halve the malaria burden in the countries with a high malaria burden;
2) To eliminate malaria in countries with a low malaria burden;
3) To prevent re-establishment of malaria transmission in malaria-free countries. The key technical approaches to achieve the objectives are:

- Promotion of access to reliable diagnosis and effective treatment;
- Scaling up use of effective vector control preventive measures and;
- Supporting prevention and control of malaria in epidemic and complex emergency situations.

Supportive approaches, including strengthening capacity of national programmes at all levels, partnership with all relevant sectors and agencies, strong malaria surveillance, monitoring and evaluation systems and operational research, are emphasized in order to deliver those technical interventions.

Challenges facing the malaria control and elimination programmes

The control programmes in malaria-endemic countries are facing several challenges as follows:

- Limited coverage and low quality of laboratory services for diagnosis in high-burden countries;
- Weak health information and malaria surveillance systems which are unable to provide reliable data on the malaria burden, reported figures representing only a fraction of estimated cases;
- Limited access to effective treatment and preventive measures;
- The need to strengthen leadership and management skills at national and sub national levels;
- Lack of compliance of the private sector with national policies and guidelines;
- Weak community involvement and lack of community structures to deliver the interventions to remote and inaccessible populations;
- Elimination programmes are confronted with several obstacles, including:

✓ Limited expertise in malaria elimination and weak national capacity for implementing elimination interventions;
✓ Lack of accurate and updated stratification map of malaria transmission;
✓ Lack of effective strategies for coordination of cross-border activities among some countries;
✓ Weak intersectoral coordination

The programmes face an additional constraint concerning spreading resistance to the available medicines and insecticides, which requires monitoring and containment of resistance. The unstable political situation in some areas, due to war or civil unrest, globalization and the rapidly changing dynamics in environment, climate and migration also pose formidable challenges. The support currently provided by many global partners, including Global Funds for health systems, will assist countries in addressing several gaps related to infrastructure and human resources.

Proposal for a regional strategy for malaria elimination

Feasibility
With the continuing reduction of malaria burden in countries of the Region, availability of new tools (including ACTs, rapid diagnostic tests and LLINs), improvements in communication technology, availability of financial resources, mainly from the Global Fund but also from other sources, as well as the global interest in elimination, it has become realistic to aspire to more ambitious and accelerated efforts to eliminate malaria from the Region. With the current tools, it is feasible to achieve interruption of transmission and malaria elimination in areas with low unstable transmission, which represent most areas of the Region. In high and stable transmission areas in the southern zone of Somalia and southern Sudan, which represent only 5% of the population at risk for malaria in the Region, complete interruption of transmission may require additional new control tools, nevertheless more than 90% reduction could be achieved by full-scale deployment of the available tools.

Regional objectives for elimination of malaria in countries by 2020 and afterwards

- Eliminate falciparum malaria from the Asian countries in the Eastern Mediterranean Region;
- Limit vivax malaria transmission to a few foci in “hot” pockets in Afghanistan and Pakistan with marked reduction of incidence (annual parasite incidence <1 per 10 000 population at risk);
- Eliminate malaria in Djibouti, north and central zones of Somalia and northern Sudan except from a few foci in the hard-to-reach and border areas (annual parasite incidence <1 per 10 000 population at risk);
- Eliminate malaria as a public health problem in southern Sudan and southern zone of Somalia (malaria prevalence among fever cases < 5% and no mortality from malaria);
Sustain the efforts after 2020 to consolidate the achievements, and prevent re-emergence of malaria

Prerequisites for malaria elimination

Malaria elimination needs a holistic and integrated approach based on the existing network of basic health services. It requires, and will contribute to, strengthening the health system, with full involvement of the private sector, nongovernmental organizations and community-based programmes to ensure universal access to effective tools for diagnosis, treatment and prevention for all at-risk populations, including expatriates and refugees, free of charge. Establishing a strong information and surveillance system is of high priority to monitor and evaluate the progress. Crucial requirements for malaria elimination are:

- Political commitment with adequate sustainable funding;
- Strong leadership and skilful management;
- Sound planning based on understanding of the local epidemiology and on scientific evidence from operational research;
- Trained and motivated health workers;
- Collaboration and integration with all relevant sectors and programmes;
- Functional intercountry cooperation

Programme phases and milestones on the path from control to malaria elimination

A phased approach will be applied, guided by milestones to reorient the national malaria programme from control through pre-elimination and elimination, to prevention of reintroduction. The programme to reach the elimination goal can be started in the whole country or in a specific area (province, state or a district of not less than 100 000 population), based on the findings of a feasibility assessment. This will require detailed and updated stratification of malaria transmission and risk mapping. The decision to move from one programme phase to the next will be based on certain milestones. When the incidence rate is decreased to 5 new cases per 1000 population at risk per year, meaning the slide positivity rate (SPR) among suspected fever cases is less than 5%, the programme can be reoriented from control towards elimination with a transition phase called 'pre-elimination' in which preparation for elimination should be made. When malaria distribution becomes increasingly patchy, the incidence rate declines to below 1 per 1000 population at risk, and necessary changes in the strategy and all required adaptations have been made, the country can move to elimination.

Sequential elimination of parasite species

Experience shows that elimination of P. falciparum is easier than P. vivax. Current malaria control tools make P. falciparum elimination programmes more feasible.
because: rapid diagnostic tests have a higher sensitivity for P. falciparum compared with those currently available for P. vivax; the duration of treatment with ACTs for P. falciparum (3 days) is considerably shorter than the 14 days required for radical treatment of P. vivax with primaquine; and detection and treatment of hypnozoite carriers in vivax malaria is cumbersome with the current tools.

In countries of the Region with both species (Afghanistan, Islamic Republic of Iran and Pakistan) elimination could be planned sequentially, with priority given to falciparum malaria first as the more severe problem. Anti-falciparum activities would affect the vivax malaria as well. Such an approach has been documented in many countries (e.g. Morocco, Tunisia).

**Conclusions**

Malaria can be eliminated with the current tools from most areas of the Eastern Mediterranean Region as transmission is low and unstable. In the few high and stable transmission areas in southern Sudan and the southern zone of Somalia transmission can be markedly reduced and will result in eliminating malaria as a public health problem. The decision to proceed to elimination in those areas needs political stability and strong health and surveillance systems. In all countries, government interest in elimination is required and must be sustained even when the malaria burden is greatly reduced in order to achieve the desired elimination goal. The malaria situation in neighbouring countries will have to be taken into consideration in the decision to proceed to elimination. Regional initiatives and donor support to multicountry elimination projects must be encouraged to stimulate establishing functional intercountry cooperation.

WHO will provide the necessary technical support to countries to develop, implement and evaluate their plans for malaria elimination. WHO will assist countries in their efforts to mobilize resources for malaria programmes and health system strengthening, as well as in building the national capacity for malaria elimination and in coordination of cross-border activities. More investment in research will be required to develop novel tools and innovative strategies to address the challenges facing the programme in all phases and different settings, including complex emergency situations.

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Summary of findings:

Afghanistan has the second highest reported burden of malaria in Eastern Mediterranean Region and the fourth highest worldwide outside of sub-Saharan Africa. The identified vectors of malaria are An. culicifacies, An. stephensi in the east, An. pulcherymus in the north, and An. superpictus in hill areas north and south of the Hindu Kush mountain range. These vectors breed mainly in pools, rivers and irrigated rice fields. Their abundance is largely determined by the presence of water and the variation in river flow. As most of the country is mountainous desert, the distribution of malaria is likely to be limited to areas where ecological factors favor the development of vector and parasite. Malaria is predominantly present at altitude below 2000 meters above sea level in river valleys and areas used for rice cultivation. High potentials for malaria transmission exist in 14 out of the 34 provinces with 14 million people at risk of contracting the disease. The risk is higher among children and young adults because of partial immunity.

Initial control efforts brought a marked decline in the number of reported cases of malaria from 626,839 cases in 2002 to 271,763 cases in 2004. However, from 2004, the number of reported cases increased steadily to reach 433,412 cases in 2007 yielding a rate of 19 cases per 1000 population. Nearly 70% to 90% of malaria cases are due to P. vivax while 10% to 30% are due to the life threatening P. falciparum. There is a marked decline in the number of confirmed cases of P. falciparum over the years. In the 1990’s, P. falciparum cases accounted for 20% of all reported cases of malaria. This rate declined to 7.2% in 2006 as out of 86,476 cases of malaria ascertained by microscopy or rapid diagnostic tests, 6,205 cases were due to P. falciparum infection. In 2002, a cross section survey of 4,336 individuals in 50 districts from altitudes 333 to 2,956 meters conducted during the peak transmission season of P. falciparum revealed an overall prevalence of 2.0% being 2.7% in altitude less than 1,500 meters. P. falciparum accounts for 29.0% of malaria infections and 26.5% of infections in altitude less than 1,500 meters. In this altitude, 3.8% of febrile illnesses are attributed to falciparum malaria.
The current survey aims to define the epidemiology of *P. falciparum* infection and to characterize patterns of treatment seeking behaviors among different population subgroups in the Islamic Republic of Afghanistan based on the extensive study of random representative samples from 10 provinces across the country with different levels of risk for infection during the peak transmission season. The ultimate goal is to develop base line indicators to guide malaria control program at provincial and national levels. Information will be also used for targeted interventions at provincial level as well as for the monitoring of progress towards the prevention and control of the life threatening *falciparum* malaria.

The survey was conducted in November 2008 in 10 provinces across the country selected purposefully to represents different levels of malaria transmission risk. Selected provinces with high potential risk of malaria transmission are Kandahar, Nangarhar, Kunar, Badakhshan, Baghlan and Hirat. The other three provinces are Nimroz, Jowzjan and Bamyan. In the latter, the risk of malaria transmission is negligible.

A pre-tested questionnaire interview administered in Dari was used to collect information about household members, bed net availability and utilization, fever at the time of the survey and in the previous two weeks as well as the actions taken to treat the fever. Capillary blood was obtained by finger prick to test for malaria infection using microscopy. Also, blood spot was collected on Whatman’s filter paper to test for malaria specific antibodies to explore age specific historical exposure.

**Summary of main findings**

1. **Characteristics of the surveyed households**

A total of 1 559 households were surveyed in 10 provinces of different levels of malaria risk across Afghanistan. The largest proportion of these households was in rural localities (65.9%).

The majority of the surveyed households (83.3%) were headed by a man. The majority of the heads of the households were either illiterate (65.0%) or just able to read (3.8%).

The rate of literacy was higher in urban localities (40%) compared to rural ones (26.6%). Nearly two thirds (65.2%) of the heads of households have never been to school being 57.1% in urban localities and 69.4% in rural localities.

The main source of water for the surveyed population was well and springs (63.6%) and rivers or ponds (25.3%). One tenth (10.6%) of households had water piped inside dwelling and in 14.6% of the surveyed households water was piped to a nearby spot. The proportion of households with piped water inside dwelling was higher in urban localities (21.2%) than rural ones (5.1%).

The predominant types of latrines were trench or bucket (67.0%) followed by pit latrine (21.5%) in both urban (56.4% and 25.8% respectively) and rural localities (72.4% and 19.3% respectively). Flush toilet was present in only 6.7% of the surveyed
households being 14.5% in urban localities and 2.7% in rural localities. Less than half of the surveyed households have electricity supply (44.7%). Two thirds (68.6%) of households in urban localities have electricity supply compared to 32.3% of households in rural localities. Two thirds (64.1%) of the households had radio and 37.8% had a television. Just half (50.3%) of the households had a telephone either a landline and/or a mobile telephone. A much lower proportions of households had fan (18.6%), refrigerator (12.1%) and only 1.7% had an air conditioner. All these proportions were considerably lower in rural areas compared to urban ones. Nearly equal proportions of households in urban and rural localities had a car (8.3% and 9.3% respectively) and motorcycle (25.0% and 24.1%).

Nearly half (53.8%) of the surveyed households had livestock including goats, sheep, cows and donkeys. The proportion of household which had livestock was higher in rural areas (68.5%) than urban ones (25.4%). Households were classified into wealth quintiles based on household assets, livestock, source of water supply and type of latrines. Nearly equal proportions (20.0%) of households fell in each wealth quintile.

2. Characteristics of the surveyed population

This survey included a total of 11,307 individuals, two thirds of them were rural dwellers (66.2%). Men constituted 46.4% of the surveyed population while 53.6% were women. Just less than half of the surveyed women in both urban (46.8%) and rural localities (46.2%) were in the reproductive age group (15 to 49 years). Children below the age of 15 years represented slightly more than half of the surveyed population in urban (51.2%) and rural localities (54.0%).

More than half (61.2%) of the surveyed population was illiterate. The proportion of illiterate population was slightly higher in rural areas (65.4%) than urban ones (53.4%). Nearly one third (34.4%) of the surveyed population above the age of 6 years received formal education. This proportion was higher in urban (42.0%) than rural areas (30.2%).

At the time of the survey, only 13% of the surveyed population above the age of 5 years was employed. This proportion was lower in rural areas (9.7%) than urban ones (14.4%). Very few of the employed were children in the age group of 5 to 9 years (n= 4) and 10 to 14 years (n= 43). Almost a third of the employed were drivers (35.0%) and another third were skilled (16.2%) or semiskilled and manual laborers (14.1%). Just less than a quarter (23.7%) was employed in professional or semiprofessional occupations. More than three quarters (78.4%) of those who were employed at the time of the survey were employed for cash while 21.5% were employed for food.

3. Bed net coverage and utilization

Bed net coverage

Just more than a quarter (26.7%) of the surveyed households had at least one bed net. The highest proportion of households
with at least one bed net was encountered in Kunar (74.3%) and Khandahar (67.4%) while the lowest in Bamyan (n=3, 3.9%), Hirat (6.2%) and Faryab (7.1%). None of the surveyed households in Nimroz had bed nets. Coverage with bed nets was lower in rural areas (23.2%) compared to urban ones (33.6%). In urban areas, coverage rate of more than 74% was encountered in Kunar (83.3%) and Khandahar (74.2%) while the lowest coverage was in Faryab (4.5%) and Hirat (1.0%). In rural area, the highest coverage with bed net was in Kunar (72.4%). Of the 417 households having bed net, slightly more than half had one (28.8%) or two (28.8%) bed nets and nearly one tenth (11.2%) had 5 or more. Presence of more than one bed nets in the household was encountered in nearly two thirds (66.5%) of households in urban areas and 74.8% of those in rural areas. At least one bed for two persons was available in 19.2% of the households with bed nets. Proportion of households with insecticides treated bed net was 20.6% including ITNs (10.7%) and LLINs (9.9%). Proportion of households with untreated and locally made bed nets was much lower (3.5% and 5.1% respectively). ITNs were more frequently encountered in Khandahar (36.0%) and Nangarhar (28.3%) while the less frequently encountered in Hirat (0.3%), Jawazjan (1.0%) and Faryab (5.4%). LLINs were encountered in more than half of the households in Kunar (54.3%). They were less frequently encountered in Baghlan (20.9%) and Nangarhar (18.9%).

In urban localities, coverage with insecticides treated bed net was 26.1% including ITNs (16.5%) and LLINs (9.6%). In rural localities, coverage with insecticides treated bed net was 17.8% including ITNs (7.7%) and LLINs (10.1%). Just less than half of the household in the wealthiest quintile (42.0%) have bed net. This proportion decreases in the lower quintile of wealth to reach only 15.7% of households in the lowest quintile of wealth.

**Information on the identified bed nets:**

A total of 1,086 bed nets were identified in 417 households; more than two thirds were either ITN (36.0%) or LLINs (39.9%). ITNs were the most prevalent type in Faryab (64.0%) followed by Nangarhar (53.6%) and Badaghshan (42.9%). LLINs were the most prevalent type of bed nets identified in Baghlan (87.8%) and just more than half of those encountered in Kunar (55.6%) and Badaghshan (57.1%). The majority of bed nets identified in Hirat (92.3%) and Jawazjan (85.7%) were locally made bed nets. More than 90% of the bed nets were acquired from health clinics (47.9%) and private shops (45.5%) while very few were acquired through NGO’s (2.8%), EPI program (1.3%), antenatal clinics (0.4%) or other sources (1.8%). Just more than a quarter (27.0%) of these bed nets were acquired within less than 6 months of the survey, 14.4% within 6 to less than 12 months and 12.4% within 12 to less than 18 months.
Only 11.0% of the bed nets were distributed free while 89.0% were purchased at a mean cost of 160.43 AFG. The lowest price paid for bed net was 100 AFG and the highest 800 AFG.

The majority of bed nets (85.5%) were treated after being acquired. These nets were treated since an average of 2.10 months ranging from 1 to 48 months. All the bed nets identified in Hirat, Baghlan, Badaghshan, Bamyan, Jawazjan and Faryab were treated within 6 months of the survey. Only 16.6% of the bed nets were used the night before the survey and the number of persons who slept under these bed nets ranged from 1 to 4.

**Sleeping under bed net:**

Less than a quarter (22.1%) of the surveyed population reported the habit of sleeping under bed nets. This proportion was higher in urban areas (31.3%) compared to rural ones (17.5%). The habit of sleeping under bed net was more frequently reported by the surveyed population in Khandahar (66.9%) and less frequently by those surveyed in Nangarhar (34.5%), Jawazjan (26.4%), Baghlan (20.0%), Badaghshan (18.9%), Hirat (5.7%) and Faryab (6.0%).

The habit of sleeping under bed net was more frequently reported by rural populations than urban ones in Hirat (7.4% and 0.0% respectively), Baghlan (27.7% and 16.7% respectively), Nangarhar (36.5% and 29.4% respectively), Jawazjan (29.7% and 22.0% respectively) and Faryab (6.7% and 1.3% respectively).

The habit of sleeping under bed nets was higher among those in the upper wealth quintile (8.3%) and decreases among those in the lower wealth quintiles to reach only 1% for those in the poorest quintile. Only 4.2% of the surveyed population reported sleeping under bed net the night of the survey. The highest proportion of those who reported sleeping under bed net the night of the survey was in Badaghshan (19.6%). In all other provinces, this proportion ranged from 0.0% in Hirat to 7.3% in Nangarhar. The night of the survey, less than 2% reported sleeping under ITNs (1.5%) or LLINs (1.9%) and less than 1% reported sleeping under untreated bed net (0.7%) or locally made bed nets (0.2%).

Sleeping under bed net the night of the survey was reported by less than 5% of the surveyed population in urban (4.7%) and rural areas (4.0%). Nearly equal proportions of the surveyed population in urban and rural areas reported sleeping under ITNs (1.9% and 1.3% respectively) or LLINs (1.7% and 2.0% respectively). Sleeping under untreated bed net was reported by less than 1% of the population in urban (0.6%) and rural areas (0.7%).

Among those in the upper quintile of wealth, 39.5% reported the habit of sleeping under bed. This proportion was 18.1% in the third quintile and 5.4% in the lowest quintile. Similarly, among those in the upper quintile of wealth, 6.4% reported sleeping under bed net the night of the survey. This proportion was 4.3% among those in the third quintile and 2.8% among those in the lowest quintile.
Barriers for acquiring bed nets:

The cost of bed net was the barrier that prevented 74.5% of the head of households to acquire it. The unavailability of bed nets in the local market was the barrier that came next (31.2%) mainly in Jawazjan (60.3%), Nimroz (53.8%) and Baghlan (53.8%). Less frequent reasons given for not having bed nets were mosquitoes not being a problem in the area (11.6%) as well as malaria (6.0%), the belief that bed nets are not effective in reducing mosquito bite (2.1%) and malaria infection (1.8%) and that insecticides used for its treatment pose a health hazard (0.9%). The majority (83.8%) of the heads of households were not certain that they will use bed nets in the events it is provided. Almost one tenth stated that they are going to use it either in some nights (2.6%) or every night (8.8%).

Advantages and disadvantages of using bed nets:

Avoiding the painful mosquito bite and minimizing the risk of malaria was the advantage of using bed net stated by nearly 80% of the heads of household having a bed net followed by sleeping better under bed net (40.8%). Disadvantages stated include warming the sleeping place (11.3%), feeling no air (9.4%), time taken to tuck it in (7.0%) and difficulty in getting up in the middle of the night (6.2%).

4. Prevalence of fever

Point prevalence of fever:

The prevalence of self reported fever the day of the survey was very low (6.5%). The prevalence was higher in rural areas (8.0%) than in urban areas (3.8%). The highest prevalence of self reported fever the day of the survey was encountered in Kunar (19.6%), Nimroz (19.2%) and Hirat (14.2%). In other provinces, the prevalence was very low reaching 0.0% in Jawazjan and Faryab.

Temperature at the time of the survey was recorded for 83.3% of the surveyed population. Point prevalence of fever among the surveyed population was 3.2%. The highest rates were encountered in Kunar (14.2%) and Nimroz (16.9%). In all other provinces, the point prevalence of fever ranged from 0.5% to 5.8%. Point prevalence of fever was slightly higher in rural areas (3.8%) than in urban ones (2.0%). Out of the 8983 individuals who had their temperature recorded, nearly equal proportion of those in the upper quintile of wealth (4.1%) and lowest quintile (4.4%) had fever the day of the survey. This proportion ranged from 2.2% to 2.4% the second to the fourth quintiles.

Period prevalence of fever:

Two-week period prevalence of fever was 3.4%. The highest prevalence was encountered in Kunar (14.6%). In other provinces, the 2-week period prevalence ranged from 0.8% to 7.5% except for Jawazjan and Faryab where none of the
surveyed population reported fever in the two weeks prior to the survey. The 2-week period prevalence of fever was 2.5% in urban areas and 3.9% in rural areas. Out of the 383 subjects who reported fever in the two weeks prior to the survey, 270 (70.5%) reported that the fever resolved after a duration ranging from 1 to 28 days while in 113 (29.5%) fever persisted. In each of the wealth category, nearly equal proportions reported fever in the two weeks prior to the survey. These proportions ranged from 3.4% (lowest quintile) to 3.9% (third and fourth quintile).

**Symptoms associated with fever reported in the two weeks prior to the survey:**

The majority (82.0%) of subjects who reported fever in the two weeks prior to the survey reported the association of fever with symptoms. Symptoms associated with fever were reported by 85.1% of those who experienced fever in the two weeks prior to the survey in urban areas and 81.0% of those in rural areas. Headache and malaise was the most frequently reported symptoms in association with fever (48.0%) followed by sweating and chills (33.9%) and body aches (27.7%). The most frequently reported symptom suggestive of gastrointestinal infections was nausea and vomiting (13.1%) followed by diarrhea (5.0%) and abdominal pain (4.7%). Symptoms suggestive of respiratory tract infections included cough (17.2%), sore throat (8.9%), difficult breathing (5.7%) and running nose (4.2%).

5. **Parasite prevalence**

Out of the 10 736 blood samples examined by microscopy, 45 were positive for the parasite yielding a prevalence of 0.4%. Nearly two thirds (66.7%) of positive cases were positive for P. vivax while 33.3% were positive for P. Falciparum. Positive cases for malaria parasite were encountered among the population surveyed in only four provinces namely Kunar (2.2%), Nangarhar (1.4%), Baghlan (0.3%) and Faryab (0.3%). All positive cases except two were from rural localities. Among those in the fifth and fourth quintiles of wealth 0.3% were positive for the parasite. This proportion was 0.6% among those in the third quintile and 0.7% among those in the lowest quintile of wealth.

6. **Health seeking behavior for fever**

**Action taken to treat the fever reported in the two weeks prior to the survey:**

Of the 383 cases of fever reported in the weeks prior to the survey, 59.8% took action to treat the fever. The proportion of those who took action to treat the fever was higher in urban areas (71.3%) than in rural ones (56.1%). Among fever cases who fell in the upper quintile of wealth, 69.6% took action to treat the fever. This proportion ranged from 60.2% to 62.8% in the fourth to the
second quintile and reached 45.2% in the lowest quintile of wealth.
Just more than half of those who took an action to treat the fever sought a health care facility (53.3%), 22.3% visited a drug store and 18.3% decided on self management. Only 8.3% consulted a traditional healer and few (1.3%) consulted a Mullah.
In urban area, less than half of fever cases who took an action sought a health care facility (47.8%), 22.4% visited a drug store and 11.9% decided on self management. In rural areas, just more than half (55.6%) of those who took an action to treat the fever sought a health care facility, 22.2% visited a drug store and 21.0% decided self management.
Of those who took action to treat the fever, nearly equal proportion of those in the upper wealth quintile (66.7%) and fourth quintile (65.9%) visited a health facility. This proportion was 69.7% among those in the lowest quintile of wealth and the highest among those in the third (78.0%) and second (85.2%) quintiles.
Action to treat the fever was initiated by 42.4% within less than 24 hours of the onset of fever and 39.3% initiated the action between 24 hours to less than 48 hours of its onset. Only 18.3% took action 48 hours to more than 72 hours of the onset of fever. Nearly equal proportion of those who took action in urban and rural areas initiated the action within less than 24 hours of the onset of fever (44.8% and 41.4% respectively) and 24 to less than 48 hours of the onset of fever (38.8% and 39.5% respectively).
In respect to treatment received, 56.8% received antipyretics and 34.1% received antibiotics. Few received antimalarial drugs (n=18; 7.9%) in Badagshan (n=11; 57.9%), Nangarhar (n=5; 25.0%), Bamyan (n=1; 8.3%) and Kunar (n=1; 2.0%).

Information on health care facility visited to treat the fever:

Governmental health facility was visited by nearly half (51.5%) of those who sought a health care facility for the treatment of fever. Governmental health facility was visited by a slightly higher proportion of those who sought health care facility for the treatment of fever in urban area (55.6%) than in rural ones (49.9%).
The most frequently visited facility was comprehensive health care facility (24.3%) followed by provincial hospital (11.2%), district hospital (4.1%), regional hospital (3.6%), basic health care unit (7.7%) and Health post (0.6%).
Private health facility was visited by 18.9% of those who sought health care facility for the treatment of fever including private clinic (18.3%) and private hospital (0.6%). Private clinic was visited by nearly equal proportions of those who sought health care facility for the treatment of fever in urban (17.8%) and rural areas (18.5%).
Just more than a quarter (26.6%) of those who sought health care facility of the treatment of fever visited a drug store. Drug store was visited by nearly equal proportions of those who sought health care facility for
the treatment of fever in urban areas (26.7%) and rural areas (26.6%).

The mean travel time to the health care facility was 41.07 minutes with a minimum of 1 minute and a maximum of 180 minutes. In urban areas, the travel time to the health facility was for an average of 20.11 minutes (Min=5, Max = 60). A longer travel time of 48.73 minutes (Min=1, Max=180) was encountered in rural areas.

The mean waiting time was 41.64 minutes with a minimum of 1 minute and maximum of 300 minutes. In urban areas, the mean waiting time at the health facility was 32.49 minutes (Min=1, Max=280) while it reached 44.98 minutes (Min=1, Max=300) in rural areas.

For all provinces combined, two thirds (66.3%) of the consultations were free and a third (33.7%) paid an average consultation fees of 69.21 AFG (Min= 2, Max=150). The proportion of free consultations was much higher in rural areas (73.4%) than in rural ones (46.7%). However, the average consultations fees was lower in urban areas (57.92 AFG; Min=2, Max=150) than in rural ones (77.42 AFG; Min=5, Max=150).

Less than a quarter (40/169; 23.7%) of those who visited a health care facility had their blood tested for malaria and 55.0% (22/40) reported a positive test while the other reported a negative test (18/40). Only 12 out of the 40 were charged for their blood test an average fees of 46.75 AFG (Min=1, Max 150).

**Information on antimalarial treatment:**

Out of the 169 subjects who sought a health care facility, 18 received antimalarial drugs. Only one in Nangarhar received SP/Fansidar while the other 15 cases received chloroquine. Antimalarial drugs were more frequently provided by the health facility (77.8%) than being purchased from a drug store (16.7%). Only 5 out of the 18 were incurred the cost of medication which was 20 AFG in average.

**Barriers for taking action and/or seeking a health care facility:**

The most frequently perceived barriers were mild nature of the fever (39.3%) and believe that the fever will resolve spontaneously (29.4%). For just less than half (46.0%), the barrier was the unaffordable cost of consultation. The most frequently stated barriers for seeking a health care facility were the unavailability of health care facility (24.5%) and the long travel distance (22.7%). Low proportions stated the quality of health care provided as a barrier namely shortage of diagnostic facilities (11.0%) and inadequacy of the care provided (10.4%). Less frequent barriers related to the quality of care of relevance to health care workers were inefficient health workers (n=4, 2.5%), workers are not nice (n=3, 1.8%), and unavailability of health workers (n=2, 1.2%).
7. Public knowledge of malaria and preventive measures

More than half of the surveyed population perceived that they are living in provinces where malaria is a low (48.8%) or very low (5.2%) risk. Living in high risk provinces was stated by more than half of the population surveyed in Jawzjan (59.9%) and almost a third of those in Kandahar (33.1%), Baghlan (33.0%) and Nangarhar (32.9%).

Of the surveyed population above the age of 11 years, 20.1% had no knowledge of how malaria could be presented. This proportion was slightly higher in rural areas (21.6%) than urban ones (17.3%). Manifestations of malaria stated in order of frequency by urban and rural population were fever (51.5% and 44.5% respectively), cold or chills (32.7% and 26.7% respectively), sweating (11.6% and 8.4% respectively), and diarrhea (1.3% and 1.4% respectively).

Less than two thirds (60.8%) of the population above the age of 11 years recognized that malaria is transmitted by mosquito bite. This proportion was slightly higher in urban localities (64.0%) than in rural ones (59.0%). The remaining proportion either they did not know how the disease is transmitted (25.2%) or had incorrect knowledge of how it is transmitted (14.0%).

Nearly a quarter (23.8%) of the surveyed population did not know the best preventive measure for malaria. This proportion was slightly higher in rural areas (22.2%) than in urban ones (18.9%). Less than half of the surveyed population (46.0%) perceived bed net as the best measure to prevent malaria.

This proportion was lower in rural areas (42.3%) than in urban ones (52.8%). For 10% of the surveyed population, the best preventive measures of malaria was spraying of insecticides (7.0%) and screening of windows (3.0%). The least frequently stated best preventive measures include the use of mosquito repellants by local application (0.6%) or coils (0.1%) as well as the use of prophylactic anti-malarial medications (0.4%).

Less than half (43.1%) of the surveyed population reported receiving health education messages addressing areas related to malaria transmission and disease prevention. This proportion was higher in urban areas (53.5%) than in rural ones (31.2%). Health facility was the most frequently (30.6%) stated source of information about malaria. Mass media ranked the second source of information including radio and television (29.1%) as well as newspapers (27.5%). School was the source of information for 23.4% of the surveyed population. Less frequently stated source of health education includes mosque (8.4%), workplace (4.2%) and educational materials (6.0%). Areas of health education included disease prevention (71.2%), transmission (51.5%) and treatment (25.8%).

Conclusion and Recommendation:

The survey was accomplished successfully in 10 provinces with different levels of malaria endemicity during the peak transmission season of P. falciparum. The sample selected provided a representation of all population
subgroups that adequately mirrored the population of the 10 provinces.

Bed net coverage is low (26.7%) with a much lower coverage with ITNs (10.7%) and LLINs (9.9%). Coverage with bed nets is low in rural areas (23.2%) and high risk provinces including Hirat (6.2%) and Faryab (7.1%) and Nimroz (0.0%) where population are at a much higher risk of malaria. The least wealthy has lower access to bed net. Majority of bed net (89.0%) available at community level were purchased and the cost of bed net was the barrier that prevented 74.5% of the head of households to acquire it.

Less than a quarter (22.1%) of the surveyed population reported the habit of sleeping under bed nets. This proportion is especially low in rural areas (17.5%) than urban ones (31.3%). The night of the survey less than 5% of the surveyed population in urban (4.7%) and rural areas (4.0%) slept under bed net. Only 16.6% of the bed nets available to the population were used the night of the survey.

The prevalence of self reported fever the day of the survey was very low in both rural areas (8.0%; 95%CI= 7.35, 8.59) and urban areas urban areas (3.8%; 95%CI= 3.18, 4.42). Also the point prevalence of fever at the time of the survey was low (2.8%; 95%CI= 2.57, 3.27) among rural (3.8%) and urban (2.0%) population.

Two-week period prevalence of fever was low in urban (2.5%) and rural (3.9%) areas. These fevers were mostly due to respiratory and gastrointestinal infections as reflected by the described associated symptoms and the fact that most of them received antipyretics (56.8%) and/or antibiotics (34.1%) that resulted in a cure or improvement of the condition in 86.4% of the instances.

Only 40 out of the 169 who visited a health care facility for the treatment of fever reported in the two weeks prior to the survey had their blood tested for malaria and 22 out of them reported a positive test. Only 18 patients reported receiving antimalarial drugs in Badagshan (n=11), Nangarhar (n=5), Bamyan (n=1) and Kunar (n=1); 16 of them were rural dwellers and 15 reported receiving chloroquine.

Just more than half of those who reported fever in the two weeks prior to the survey (59.8%) took action to treat the fever and nearly half of them (53.3%) visited a health care facility. Governmental health facility was visited by nearly half (51.5%) of those who sought a health care facility for the treatment of fever. Patients had to travel for an average duration of 41.07 minutes and to wait for an average duration of 41.64 minutes to be seen. Only 33.7% incurred the cost of consultation which was on average 69.21 AFG. For those who did not take any action to treat the fever as well as those who did not visit a health care facility, the most frequently stated barriers were the unavailability of facility in the area of residence (24.5%), the long travel distance to
the facility (22.7%) as well as the unaffordable cost of consultation (46.0%).

General public should be encourage to use the available health care facilities in the event if sickness. All stated barriers for visiting health care facility should be considered by the MoPH in the respective provinces to ensure appropriate diagnosis and adequate treatment including the long travel and waiting time at the facility as well as the cost of consultation.

At the time of the survey, only 45 subjects were positive for the parasite yielding a point prevalence of 0.4%. In view of the low point prevalence and the predominance of P. vivax, information that will soon be available from analysis of the blood drops collected on filter paper will provide a better insight into situation of malaria in the surveyed provinces by describing historical infection among the population. Research is needed into disease vector to identify potential risks of transmission.

Nearly a quarter (23.8%) of the surveyed population did not know the best preventive measure for malaria and less than half (46.0%) perceived bed net as the best measure to prevent malaria. Health education messages should address measures of prevention against malaria with special emphasis on effectiveness of insecticide treated bed nets. Health education messages should as well take into consideration the misconception of the population related to the health hazards of using insecticide impregnated. Health care facilities should consider health education activities of relevance to malaria as part of the routine services provided to the population. Health education messages using mass media will ensure the wide spread of accurate and up to date information. Radio and television are the most suitable mass media in view of the high rates of illiteracy among the population.

The information, reports and lessons learned from this survey should be made available to
all partners. A national seminar including all partners and the health staff involved in the survey will create a sense of ownership and facilitate usage of information and implementation of the survey recommendations. The data base of the survey should be linked to the available geographical information systems for further spatial analysis of the information. Using the experiences and lessons learned from this survey, a population based survey should be planned for other malarious areas which were not part of the survey at this stage. Survey results and experiences should be shared with the international community. MoPH of Afghanistan is encouraged to prepare a scientific paper for publication in international journals.

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Abstract:
Routine antimalarial drug resistance testing was conducted at three Malaria Reference Centres in Afghanistan using a standard WHO in vivo study design. Patients with confirmed uncomplicated P. falciparum were treated with either sulfadoxine-pyrimethamine (SP) + Artesunate and followed for 28 days. Patients with P. vivax infection were treated with chloroquine (CQ) at standard dosage and followed for 28 days. All drugs tested showed greater than 95% efficacy, with SP/AS showing 100% acceptable clinical and parasitological response against P. falciparum and CQ showed 100% acceptable clinical and parasitological response against P. vivax.

Background and rationale
Malaria is endemic with seasonal transmission in Afghanistan, particularly at altitudes below 1500m and near rice growing areas of the east and north east of the country. Recorded incidence in these areas is the highest in the country, more than 500/10,000 population in 2002 (1) (country average 19 cases/1000 population in 2007). Incidence exhibits a bimodal pattern, with vivax incidence peaking in July and August and falciparum in October.

Malaria incidence has been increasing steadily since the winding down of the malaria eradication program commencing in 1979. Falciparum malaria, once nearly eradicated, accounted for some 20% of reported confirmed malaria cases in 20022. However, it comprised 7% of all reported confirmed cases in 20073. Chloroquine has been widely used in the treatment of uncomplicated malaria in Afghanistan since the 1940's, and remains first line therapy in the national protocol for the treatment of confirmed vivax malaria. At the same time Sulphadoxine-pyramethamine plus chloroquine is the first line treatment for clinical malaria. Chloroquine resistance was first reported in Afghanistan in 19864. In 1999, 67% PF treatment failure was reported from a study conducted on children greater than 7 years of age in eastern Afghanistan (11% after 7 days of treatment, 55% after 14-28 days)5.

One of the cornerstones of malaria control is access to effective anti-malarial treatment. To guide the development of national malaria treatment policy for Afghanistan, anti-malarial drug efficacy data is required. Therefore, three sentinel sites have been established in Nangarhar, Faryab and Takhar
provinces in 2004 to collect the required data.

Patients and methods

The study was conducted in sentinel sites established for this purpose in the Malaria Reference Centers of Takhar, Faryab and Nangarhar provinces. Following WHO protocol6-7 on monitoring the efficacy of antimalarial drugs, patients were recruited from clients attending clinics for febrile illness. The study was conducted by the National Malaria and Leishmaniasis Control Program (NMLCP) of MoPH with technical and financial support from WHO. A 28 day in vivo efficacy study of Artesunate and Sulfadoxine-pyrimethamine (SP) was conducted. The study was commenced September (2004, 2005, 2006 & 2007) during the period of peak falciparum malaria incidence. Inclusion criteria were: history of fever in the past 24 hours; over 6 months of age; Giemsa-stained slide positive Plasmodium falciparum mono-infection (or Plasmodium Vivax) with parasite density of 1000-100000 parasites/µl; live within one-hour’s car journey of the health care center; and gave informed consent.

Exclusion criteria were: any sign of severe disease; pregnancy; currently in treatment for malaria; and febrile disease other than malaria. All patients were reviewed clinically and parasitologically. Those meeting all inclusion criteria and having no exclusion criteria were enrolled in the study.

Parasitological follow-up occurred on day 2, and parasitological and clinical follow-up occurred on days 3, 7, 14, 21, 28 and any other day the patient complained of symptoms. Slides were crosschecked externally by reliable microscopists.

Outcomes were classified as:

1. Early treatment failure (ETF): if on days 1-3 the patient suffered from severe illness or severe malaria; or if on day 2 parasitaemia was greater than on enrollment; or if parasitaemia on day 3 was more than 25% than parasitaemia on enrollment; or if there was persistent fever in the presence of parasitaemia on day 3.
2. Late clinical failure (LCF): if the patient suffered from auxiliary temperature ≥37.5°C or gave a history of fever in the previous 24 hours in the presence of parasitaemia on days 4-28.
3. Late parasitological failure (LPF): if parasitaemia, without symptoms, was recorded on days 7-28.
Results

Summary results 2004-2007:

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<th>Faryab*</th>
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<tr>
<td>ACPR</td>
<td>96%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

* data from 2004-2006 is missing. 1. PF = Plasmodium Falciparum; 2. PV = Plasmodium Vivax; 3. SP = Sulfadoxine-pyrimethamine; 4. Art = Artesunate; 5. Chlo = Chloroquine; 6. ACPR = Adequate Clinical and Parasitological Response

Conclusions and recommendations

As SP + Artesunate remain efficacious, hence it is an appropriate choice for first line therapy of uncomplicated falciparum malaria. This combination has the advantage of being clinically efficacious as well as potentially delaying the development of resistance to SP (as has been shown to occur rapidly in other settings of low to moderate transmission where SP is used as mono therapy). In addition, the combination SP plus Artesunate may decrease transmission because of the gametocidal effect of Artesunate. Moreover, it is revealed from the study finding that chloroquine is still effective in the treatment of uncomplicated vivax malaria. Therefore, it should remain as the first line treatment for uncomplicated vivax malaria and efforts must be made to improve access to quality diagnostic services.

To continue up-dating the national malaria treatment protocol, the 3 sentinel sites should be maintained and provided with adequate technical capacity to continuously monitor the therapeutic efficacy of anti-malarial drugs in Afghanistan.

References:

1 Institute of Malaria and Parasitic Diseases, unpublished data
3 Health Management Information System, MoPH, 2007
A randomised trial of an eight-week, once weekly primaquine regimen to prevent relapse of *Plasmodium vivax* in Northwest Frontier Province, Pakistan


**Abstract:**
Background. *Vivax* malaria remains a major cause of morbidity in the subtropics. Undermining the stability of the disease requires drugs that prevent relapse and provide reservoir reduction. A 14-day course of primaquine (PQ) is effective but cannot safely be used in routine practice because of its interaction with glucose-6-phosphate dehydrogenase (G6PD) deficiency for which testing is seldom available. Safe and effective use of PQ without the need for G6PD testing would be ideal. The efficacy and safety of an 8-week, once weekly PQ regimen was compared with current standard treatment (chloroquine alone) and a 14-day PQ regimen.

Methods and Principle Findings: 200 microscopically confirmed *Plasmodium vivax* patients were randomly assigned to either once weekly 8-week PQ (0.75mg/kg/week), once weekly 8-week placebo, or 14-day PQ (0.5mg/kg/day) in North West Frontier Province, Pakistan. All patients were treated with a standard chloroquine dose and tested for G6PD deficiency. Deficient patients were assigned to the 8-week PQ group. Failure was defined as any subsequent episode of *vivax* malaria over 11 months of observation. There were 22/71 (31.0%) failures in the placebo group and 1/55 (1.8%) and 4/75 (5.1%) failures in the 14-day and 8-week PQ groups respectively. Adjusted odds ratios were: for 8-week PQ vs. placebo - 0.05 (95%CI: 0.01-0.2, *p*<0.001) and for 14-day PQ vs. placebo - 0.01 (95%CI: 0.002-0.1, *p*<0.001). Analysis restricted to failures occurring in the 9 month post-treatment period confirmed that the 8-week regimen was superior to current treatment. Only one G6PD deficient patient presented. There were no serious adverse events.

Conclusions. A practical radical treatment for *vivax* malaria is essential for control and elimination of the disease. The 8-week PQ course is more effective at preventing relapse than current treatment with chloroquine alone. Widespread use of the 8-week regimen could make an important contribution to reservoir reduction or regional elimination where G6PD testing is not available.

Study Registration: The study was registered at clinicaltrials.gov (number: NCT00158587), http://clinicaltrials.gov/ct2/show/NCT00158587?cntry1=SS%3AAF&rank=2.

Introduction:

*Plasmodium vivax* is a common cause of malaria in the subtropics. Estimates put the global burden at 70-80 million cases per year (Mendis et al, 2001). Outside Africa, the disease accounts for more than 50% of all malaria cases, and in Asia it is the major cause of malaria morbidity (Hay et al, 2005). Although *P. vivax* causes relatively few deaths there is increasing evidence suggesting that severe and life-threatening complications are more common than previously thought (Barcus et al, 2007). *P. vivax* has major
deleterious effects on development and economic performance both at individual and national levels (Sachs et al, 2002); those in endemic areas may have 10-30 episodes of vivax malaria in the course of childhood or working life each resulting in 5-15 days absence from work or school.

Conventional transmission control methods targeting the mosquito vector are imperfect owing to the infectious reservoir; dormant hypnozoites in the liver produce episodes of relapse for several years after initial infection (Garnham, 1998). Relapses from hypnozoites coincide with the seasonal abundance of the vector and it is this pattern of relapse which gives the disease its stability in subtropical areas where transmission by mosquitoes is seasonal (Rowland & Nosten, 2001). Most vivax cases experience relapse and each initial infection typically causes 5-6 subsequent episodes if radical treatment is not administered. Hence a significant proportion of the burden of vivax malaria can be attributed to relapses rather than to infections resulting from transmission (Leslie et al, 2004). Despite this, there is currently no widely available safe and effective radical cure. In most malaria endemic areas glucose-6-phosphate dehydrogenase (G6PD) deficiency, a heritable enzyme deficiency, is common. For example, in Pakistan and Afghanistan, where *P.vivax* is the predominant species (Rowland et al, 2002), G6PD deficiency is common amongst Pakistani and Afghan Pashtun populations (~10%) (Bouma et al, 1995; Ali et al, 2005). Administration of a 14-day course of primaquine (PQ) (the only recommended regimen that can eliminate the hypnozoite reservoir) to G6PD deficient individuals is contraindicated due to the risk of haemolysis (WHO, 2006).

A truncated 5-day course of PQ for vivax malaria is used commonly in South Asia to reduce the risk of haemolysis and enhance adherence to treatment (WHO, 1990). Evidence from Pakistan and India demonstrates that the 5-day PQ course is ineffective at reducing relapse rates (Rowland et al, 1999; Gogtay et al, 1999). One recent review concludes that 5-day PQ is no better than chloroquine alone at radical cure (Galappaththy, 2007). A study comparing relapse rates in treatment groups that were supervised and unsupervised when treated with 14-day PQ indicated that relapse prevention was similar between the two groups suggesting comparable treatment adherence (Leslie et al, 2004). However, use of the 14-day course is only recommended where the G6PD status of the individual is known and where adherence can be assured (WHO, 2006). It is for this reason that the drug is not more widely available (Bouma et al, 1995) since G6PD testing of cases is impractical in most low-resource settings owing to lack of funds, equipment and/or expertise.

Studies from the 1960s provide evidence suggesting that successful PQ therapy is not a function of the length the treatment course, nor the concentration of drug, but of the total dosage administered. Alving et al (1960)
administered PQ over 7 days, 14 days, and 8 weeks to African Americans. Each regimen equally prevented relapse in experimentally infected vivax malaria. Extending the course length seems to reduce the risk of haemolysis; Brewer and Zarafonetis (1967) showed (in African variant G6PD deficiency) that 8 deficient individuals given 8-week PQ (total dose 410mg) showed no clinical signs of haemolysis. Subjects (n=8) given PQ twice weekly showed more marked evidence of haemolysis. Further evidence suggests that the haemolytic effects of PQ in G6PD deficient individuals are not produced by the drug itself, but by one or more of its many metabolites (Bolchoz et al, 2001; Baird, 2007). Little is known about the pharmacokinetics and haemolytic potential of the various metabolites (Fletcher et al, 1988; Mihaly et al, 1985). However, by extending the time between PQ challenges clearance of haemotoxic agents (drug metabolites) will be more nearly complete than in shorter courses involving repeated daily dosing. The haemolysis seen in shorter courses (5-7 days) is often self-limiting and there is some evidence that erythropoiesis feedback mechanisms up-regulate production of red cells in response to haemolytic challenge once acute malaria is treated (Clyde, 1981). Older erythrocytes are more susceptible to oxidative stress precipitated by PQ challenge and, in concert with the infection, results in a younger and more robust circulating population. The extended course could be safer in G6PD deficient individuals as a result of these inherent safeguards.

The aim of the study was to test whether an 8-week PQ regimen is effective at radical cure without the associated risk of haemolysis in G6PD deficient individuals. This regimen may be appropriate for deployment in resource-poor settings where G6PD testing is unavailable. It was compared to current standard treatment (chloroquine) given with 8-week placebo and to a regimen known to be effective (chloroquine plus 14-day PQ). Since treatment with chloroquine alone is current standard treatment, superiority of the 8-week course over placebo was the primary comparison.

Methods:

Location

The study was conducted in Adizai, Baghicha and Khagan villages, close to Peshawar, Northwest Frontier Province, Pakistan where Afghan refugees have been resident for more than 20 years. Malaria transmission is seasonal and predominantly due to P. vivax (85-95% of cases) (Rowland & Nosten, 2001). The villages contain Basic Health Units (BHU) run by NGOs, providing free primary health care services to the populations of the villages. Malaria control in the villages was supported by a vertical control program implemented by the NGO HealthNet-TPO and funded by UNHCR. Amongst other services, the control program provides free quality assured microscopy and treatment services for all residents. Local vivax malaria treatment policy is to treat with chloroquine alone while falciparum malaria (now constituting less than 5% of annual cases) is
treated with sulfadoxine-pyrimethamine and artesunate.

Ethical approval for the study was granted by the Pakistan Medical Research Council Committee on Bioethics and the London School of Hygiene and Tropical Medicine ethics committee. Permission was also obtained from local government agencies and the United Nations High Commissioner for Refugees. The study was prospectively registered at clinicaltrials.gov (number: NCT00158587). Sponsors and funding agencies (UNDP/World Bank/WHO Special Program for Research in Tropical Diseases; Gates Malaria Partnership) had no role in study design; collection, analysis, and interpretation of data; writing of the paper; or decision to submit for publication.

**Patient Enrolment and Follow-up:**

Patients attending the basic health units with symptoms compatible with malaria had Giemsa stained thick and thin blood films obtained by finger prick and examined by trained microscopists. Those diagnosed with *P. vivax* infection were asked to participate in the study following informed consent and if they met the inclusion and exclusion criteria. Consent was obtained in writing by patients or their guardians, and in the case of those unable to read was witnessed by a literate person. Inclusion criteria were: Patients diagnosed with *P. vivax* parasitaemia at study BHUs; Patients over 3 years of age; Patient permanently resident in the village. Exclusion criteria were: pregnancy or lactation; severe clinical anaemia (<7g/dl); *P. falciparum* and/or *P. vivax* (mixed infections); intake of any antimalarial drug in the 2 weeks prior to consultation; patients unavailable for the duration of follow up (11 months); patients with concomitant infections or disease likely to mask treatment response.

The study was designed as an open label, randomised, placebo controlled study. Patients were randomly allocated to one of the three treatment groups by study staff in the clinic once informed consent was received and inclusion/exclusion criteria assessed. For practical reasons, two randomisation methods were used. In Baghicha and Khagan villages, patients were randomised by household, whereas in Adizai randomisation was at the individual level. Randomisation lists for each village were generated using a random number list (MS Excel, Microsoft Corp., Seattle, USA) by staff not involved in patient recruitment. Patients were randomised on enrolment by study staff in the BHUs based on house number or sequential patient numbers, depending on the study site.

All patients were treated with initial 3-day chloroquine (25 mg/kg, in divided doses over 3 days) for acute disease. This was accompanied by either supervised weekly placebo once per week for 8 weeks; supervised PQ treatment, daily for 14 days (0.5mg/kg per day); or supervised PQ once per week for 8 weeks (0.75mg/kg per week). All patients were tested for G6PD deficiency at enrolment using a colorimetric test (Sigma
Diagnostics, Poole, UK). Those with G6PD deficiency were not randomised, but assigned to the 8-week PQ group in order to follow closely to assess safety.

Patients received directly observed treatment according to the dosing schedule for each treatment group. Each patient was given an appointment card and if the patient was not present on the morning of their scheduled dose they were visited in the afternoon at their home. If the patient was not present they were treated on the next day. If they were absent on this second day, they were counted as losses to follow-up. Each dose was recorded with a signature or fingerprint of the patient. Patients were monitored during the eight weeks of treatment and for nine additional months by active surveillance (being visited in their homes every two weeks) and passively on presentation at the basic health centre. Patients presenting at the basic health unit with suspected treatment failure (febrile illness) were assessed by thick and thin blood smear. If positive they were classified as a treatment failure and re-treated with the original treatment given at enrolment. Blood slides were double read by two independent microscopists, blinded to the others result.

**Statistical Issues:**

Sample size estimation was based on the assumption of 32% and 49% relapse rates in treated (14-day PQ) and untreated individuals, as recorded previously in other studies (Leslie et al, 2004; Rowland et al, 1999). Allowing for 15% loss to follow-up a sample size of 212 per treatment arm was required to detect this difference with 90% power at the 95% confidence level. Lower-than-expected enrolment rates led to a revision of sample size, following an interim analysis which showed approximated 95% vs 70% efficacy. Based on this, a revised sample size of 66 per treatment arm (allowing 10% loss to follow-up) gave a power of 90% at the 95% confidence level. The study was not powered to show equivalence between the 14-day and 8-week PQ arms.

Analysis was conducted on an intention-to-treat basis. The primary outcome was the occurrence of any episode of microscopically confirmed vivax malaria over the 11 month observation period which classified the patient as a treatment failure. Secondary outcome variables included the number of subsequent episodes and anaemia rates during and up to 2 weeks post-treatment as well as any notable adverse events. Univariate logistic regression analysis provided crude odds ratios (OR). Potential confounders (sex, age-group and village) were identified on an *a priori* basis and were included in multivariate analysis. Each treatment group was compared in turn to assess superiority (or otherwise) using logistic regression analysis, adjusting for potential confounders. Kaplan-Meier survival analysis using time to first relapse as the endpoint was used to calculate cumulative survival probability. Losses to follow-up were treated as censored data in the analysis. Data was recorded by trained health workers on
patient record forms, double entered using Excel XP (Microsoft Corp, Seattle, USA) and analysed using STATA v10.0 (Stata Corp, College Station, TX, USA).

Results:

Two hundred patients were recruited from 13th September 2004 until 17th July 2006. Follow-up was completed on 16th June 2007. The number (%) recruited into the study at each site was: Adizai 100 (50.0%), Baghicha 79 (39.5%), and Khagan 21 (10.5%). Ten (5.0%) were either lost to follow-up (9) or withdrawn owing to protocol violation (1). Seventy one (35.5%) patients were enrolled to 8-week placebo, 55 (27.5%) to 14-day PQ and 74 to 8-week placebo (37.0%). Figure 7.1 shows patient throughput during the observation period and Table 7.1 shows enrolment characteristics.

---

Figure 7.1: Trial Throughput.
Table 7.1: Enrolment characteristics of study sample, by treatment group.

<table>
<thead>
<tr>
<th></th>
<th>8-week Placebo</th>
<th>14-day PQ</th>
<th>8-week PQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>71</td>
<td>55</td>
<td>74</td>
</tr>
<tr>
<td><strong>Number lost to follow-up</strong></td>
<td>3 (4.2%)</td>
<td>1 (1.8%)</td>
<td>6 (8.1%)</td>
</tr>
</tbody>
</table>

**Study Site**
- **Adizai**
  - Number: 27
  - 8-week Placebo: 30
  - 14-day PQ: 43

- **Baghicha**
  - Number: 33
  - 8-week Placebo: 23
  - 14-day PQ: 23

- **Khagan**
  - Number: 11
  - 8-week Placebo: 2
  - 14-day PQ: 8

**% Male**
- 8-week Placebo: 58.6
- 14-day PQ: 43.6
- 8-week PQ: 48.0

**Median Age, yrs [Range]**
- 8-week Placebo: 9 [4-50]
- 14-day PQ: 10 [4-45]
- 8-week PQ: 10 [4-80]

**Median Weight, Kg [Range]**
- 8-week Placebo: 25 [12-67]
- 14-day PQ: 24 [8-70]
- 8-week PQ: 29 [11-66]

**Mean Hb on Day 0, g/dl [SD]**
- 8-week Placebo: 12.0 [1.7]
- 14-day PQ: 12.6 [1.9]
- 8-week PQ: 12.6 [1.8]

**N (%) anemic (Hb<10.0)**
- 8-week Placebo: 10 (14.1)
- 14-day PQ: 2 (3.6)
- 8-week PQ: 7 (9.5)

There were 22/71 (31.0%) failures in the placebo group and 1/55 (1.8%) and 4/75 (5.1%) failures in the 14-day and 8-week PQ groups respectively. Treatment group and village were significantly associated with treatment failure, with highest failure rates recorded in the placebo group and in Adizai village (Table 7.2). Sex was not associated with treatment failure. Multivariate logistic regression analysis of treatment outcome, adjusting for sex, age-group and village was conducted to compare each group in turn (table 7.3). By this analysis the 8-week PQ regimen was superior to placebo (AOR 0.05 [95%CI - 0.01-0.2], p<0.001), as was the 14-day PQ regimen (AOR 0.01 [95%CI - 0.002-0.1], p<0.001). Cure rates for the 14 day PQ appear slightly higher than for 8 week PQ regimens (AOR 3.8 [95%CI - 0.4-36.7] p=0.3), however the study was insufficiently powered to demonstrate equivalence or superiority.

Table 7.2: Number (%) with treatment failure in each treatment group over the 11 month observation period, by sex, age group and village.

<table>
<thead>
<tr>
<th></th>
<th>8-week Placebo</th>
<th>14-day PQ</th>
<th>8-week PQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All</strong></td>
<td>22/71 (31.0)</td>
<td>1/55 (1.8)</td>
<td>4/74 (5.1)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>10/41 (24.4)</td>
<td>0/24</td>
<td>2/35 (5.7)</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>12/29 (41.4)</td>
<td>1/31 (3.2)</td>
<td>2/38 (5.3)</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-10</td>
<td>15/46 (32.6)</td>
<td>1/30 (3.3)</td>
<td>4/38 (10.5)</td>
</tr>
<tr>
<td>11-20</td>
<td>7/20 (35.0)</td>
<td>0/19</td>
<td>0/23</td>
</tr>
<tr>
<td>&gt;20</td>
<td>0/5</td>
<td>0/6</td>
<td>0/13</td>
</tr>
<tr>
<td><strong>Village</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adizai</strong></td>
<td>18/27 (66.7)</td>
<td>1/30 (3.3)</td>
<td>4/43 (9.3)</td>
</tr>
<tr>
<td><strong>Baghicha</strong></td>
<td>4/33 (12.1)</td>
<td>0/23</td>
<td>0/23</td>
</tr>
<tr>
<td><strong>Khagan</strong></td>
<td>0/11</td>
<td>0/2</td>
<td>0/8</td>
</tr>
</tbody>
</table>
Table 7.3: Univariate and multivariate logistic regression analysis for treatment failure comparing each group. 95% confidence intervals in parenthesis.

<table>
<thead>
<tr>
<th></th>
<th>Full study period (11 months observation)</th>
<th>Restricted to failures occurring in months 2-11*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Placebo vs. 8-week PQ</td>
<td>0.1 (0.04-0.4)</td>
<td>0.3 (0.08-0.9)</td>
</tr>
<tr>
<td>Placebo vs. 14-day PQ</td>
<td>0.04 (0.005-0.3)</td>
<td>0.08 (0.01-0.6)</td>
</tr>
<tr>
<td>14-day PQ vs. 8-week PQ</td>
<td>3.1 (0.3-28.4)</td>
<td>3.3 (0.4-30.5)</td>
</tr>
</tbody>
</table>

1 Adjusted odds ratios (AOR) adjust for refugee village, sex and age.

2 Restricted analysis excludes all failures during treatment period (months 0-1).

Table 7.4 shows the number of episodes of malaria recorded during the observation period. In the placebo group, 5 additional episodes of malaria were recorded in one patient, whereas only single episodes were recorded in any of the PQ treated patients. Median time to first episode differed between groups, 62.5 days (inter-quartile range 46-130 days) (n=22) in the placebo group; 285 days (n=1) in the 14-day group and 125 days (n=4) in the 8-week group. There were too few failures for statistical assessment of differences in the median time to failure.

Table 4: Frequency of subsequent episodes of malaria in each treatment group over 11 month observation period, number (%).

<table>
<thead>
<tr>
<th>Number of Subsequent Malaria Episodes</th>
<th>8-week Placebo (n=22)</th>
<th>14-day PQ (n=1)</th>
<th>8-week PQ (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>46 (67.7)</td>
<td>53 (98.2)</td>
<td>67 (93.1)</td>
</tr>
<tr>
<td>1</td>
<td>12 (17.7)</td>
<td>1 (1.9)</td>
<td>4 (5.6)</td>
</tr>
<tr>
<td>2</td>
<td>6 (8.8)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>3 (4.4)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1 (1.5)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.5 shows the frequency of first relapse during the 2 month period of treatment and then at 3 month intervals during the follow-up period. In the 8-week placebo group 11/22 (50.0%) of failures were recorded during the first two months. Time series analysis showed cumulative survival probabilities for each treatment group (figure 7.2). Cumulative probability of failure at 11 months was 35.2% (95%CI: 25.3-47.5%) in the placebo group, 3.6% (95%CI: 0.9-13.8%) in the 14-day and 13.5% (95%CI: 7.5-23.7%) in the 8-week PQ group (long-rank test for equality of survivor functions - Chi^2=22.1, p<0.001).
Figure 7.2: Kaplan Meier Survival Analysis, by treatment group, over 11 months of observation.

Since a prophylactic effect of PQ administered over the 8 week treatment period may confound true failures, a restricted analysis was conducted which included only those who had failed treatment in the follow-up period (months 2-11, inclusive). Eleven failures occurring during the treatment period (months 0-1, inclusive) were excluded (all of which were in the placebo group). During this period there were 11/60 (18.3%) failures in the 8-week placebo group; 1/55 (1.8%) in the 14-day PQ group; and 4/74 (5.4%) failures in the 8-week PQ group. When compared by treatment group and adjusted for age, sex and refugee village, both 8-week and 14-day PQ were superior to 8-week placebo (AOR 0.1, 95% CI: 0.03-0.5, p<0.0001) and (AOR 0.03, 95%CI: 0.003-0.3, p<0.0001), respectively (table 7.3). A second time series analysis was conducted for the 9 month follow-up and indicated that the probability for failure was higher in the placebo group than either PQ treated group (long-rank test for equality of survivor functions - \(\chi^2=11.9, p=0.003\)) (Figure 7.3).
There were no reported serious or notable non-serious adverse events and all treatments were well tolerated. Only 1 G6PD deficient patient, a 13 year-old male, was detected during this trial. On days 7 and 14 (prior to the second and third PQ doses), Hb in this individual fell below the confidence limits of the mean Hb in G6PD normal females aged 12-14 (n=13). On day 7 Hb was 10.0g/dl vs 12.6g/dl (95%CI: 11.8-13.4) and on day 14 Hb was 10.6 vs 12.6 (95%CI: 12.0-13.3). By day 21 (prior to the fourth dose) Hb in the patient was within the limits of age and sex matched G6PD normal individuals (hb=12.7 vs 12.6 [95%CI: 11.8-13.5]). The haemoglobin profile of the three treatment arms in the whole sample did not differ. No patient became seriously anaemic (Hb<7.0 g/dl), and no observed anaemia was clinically significant.

**Discussion:**

The 8-week PQ regimen in combination with chloroquine is effective at curing acute vivax malaria and preventing relapses. Over a period of 11 months, new episodes of vivax malaria were more frequent in the group administered with placebo than in either PQ treated group and the superiority of 8-week PQ over chloroquine alone is demonstrated. The analysis provides information on the effect of an initial PQ treatment as well as
repeated doses. The use of incidence of first relapse as the primary outcome provides evidence that the 8-week course is superior to placebo in prevention of episodes of relapse when given as a single course. Patients who presented with a second (or further) episodes were treated with the same regimen as at enrolment. Incidence of recurrent episodes was lower in both the PQ groups; only one recurrent episode was seen in any patient, whereas up to five recurrent episodes were seen in one patient in the placebo group.

The restricted analysis, which excluded failures during the treatment period (when any prophylactic effect would be seen), confirms that both PQ treated groups are superior to placebo in preventing recurrent episodes. The pattern of failure in the 8-week PQ group, where failures occurred between two and three months post treatment, provides possible evidence of a prophylactic effect; the timing and pattern of the failures matches that of the placebo arm once the drug (and metabolites) have cleared. It could be, therefore, that failures (relapses) are simply delayed by a prophylactic effect of 8-week PQ therapy. If this were the case, however, failed patients treated with PQ for an additional eight weeks would be expected to have second relapse episodes by 8-11 months post enrolment (6-9 months post initial treatment). This effect is not seen; none of the 8-week PQ group had second relapse episodes (table 7.4). The periodicity of initial failures in the placebo group also support this; without radical treatment with PQ, failures occur in two distinct periods – between 0-3 months post treatment and between 6-9 months post treatment (table 7.5 & fig 7.3), where this is not seen in the 8-week PQ group. The 9 month follow up of each patient suggests that both PQ regimens eliminated the hypnozoite reservoir. Even though some PQ metabolites have long half-lives (Bolchoz et al, 2001), 9 months should be sufficient to allow for clearance of the drug and it’s metabolites. This makes it unlikely that the drugs are simply suppressing emergence of merozoites from latent hypnozoites and likely that the 8-week PQ course is eliminating hypnozoites and providing radical cure.

A recent meta-analysis of 14-day PQ trials describes regional variation in PQ efficacy in India, Brazil and Thailand (Goller et al, 2007). In untreated patients, relapse rates up to 80% were noted in Thailand. The median relapse rate in treated groups in India was ~10% (range 7%-21%) whereas in untreated groups it was somewhat higher, at 37%. Relapse rates in all treated groups (in all three countries) were reduced by 14-day PQ therapy. This analysis did not account for background transmission (causing re-infection), which may account for some of the variation seen between regions. It is not possible to distinguish those episodes that are true relapses from those that are re-infections; there is no reliable way of differentiating between the two (Imwong et al, 2007). Two comparable studies in this region (and, indeed, in these same villages) have shown failures in 14-day PQ groups at
32% and 19% conducted in 1996 and 2000-1, respectively, using 9 month observation periods (Leslie et al, 2004; Rowland et al, 1999). However, the villages where the present study was conducted had markedly lower transmission rates at the time (2004 to 2007) than in the previous studies conducted (HN-TPO, unpublished clinic data). 2004-2007 has been characterised by some of the lowest transmission rates recorded since the refugee crisis began. Almost all of the cases detected in the population of the villages were enrolled, and thus around 50-60% of patients received anti-relapse therapy. Against the backdrop of very low transmission in this study, the differences seen compared to the earlier trials conducted in the same villages are probably attributable to a marked reduction in the number of transmission (re-infection) cases rather than to changes in drug sensitivity. The low transmission during the study period provides circumstantial evidence for PQ susceptibility in this region. PQ resistant vivax has been reported elsewhere in Asia (Ajdukeiwicz & Ong, 2006) where it is thought to have developed through the exposure of vivax to the drug when it was widely employed to reduce falciparum gametocytes (Looareesuwan et al, 1997). In Pakistan and Afghanistan, 5-day PQ, as well as PQ for falciparum had been used for many years (although the policy was abandoned in 2001) despite which vivax appears to remain highly sensitive. Vivax also remains highly susceptible to chloroquine in this region (Leslie et al, 2007) in contrast to other areas (e.g. Papua) (Suwanarusk, 2007).

Efficacy and safety data on 8-week PQ is scarce, based on small sample sizes with no comparison group (Alving et al, 1960; Brewer & Zarafonetis, 1967). The present study is the first randomised controlled trial evidence for the efficacy of the regimen, and although effective and safe in this sample, conclusions on safety in G6PD deficient patients in general cannot be drawn. The 5-day PQ course is frequently used in the region yet there are no reports of serious G6PD related adverse events either in the literature or anecdotally following this regimen. The sole G6PD deficient patient showed a slight drop in haemoglobin, although this was not clinically significant. This may indicate that in this population, G6PD deficiency is less of a risk than currently assumed. If the eight week regimen is to be considered as policy, assessment of the safety profile in G6PD deficient patients will be needed.

An important issue in broadening access to 8-week PQ therapy is adherence to the regimen. Ensuring adherence to a 2 month, once weekly regimen will require proven interventions at the delivery level. Unsupervised 14-day PQ, accompanied by strong health education messages was similarly effective to supervised therapy in terms of treatment outcome (Leslie et al, 2004). This indicates that common concerns about adherence to treatment are, in certain cultures, unfounded. A number of studies have shown that adherence to treatment can be enhanced by relatively simple and inexpensive measures such as blister packaging, aides memoir, health education
and improved provider knowledge (Yeung & White, 2005). These interventions may be similarly appropriate for long-course PQ but will require evaluation before they are brought to scale.

Since the idea of malaria elimination (or eradication) is back on the global agenda (Roberts & Enserink, 2007), efforts to improve radical treatment of vivax malaria are required. In the absence of easily administered and widely available G6PD testing, the 8-week course of PQ should be further explored as a tool in preventing recurrent episodes of acute malaria and reducing the infectious reservoir. Widespread use of 8 week PQ has the potential to have dramatic effects on the global burden of vivax malaria.

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Conflicts of Interest [as published in original paper]:

TL, MR and CW have received funds for investigator-initiated research from GlaxoSmithKline Pharmaceuticals and CW from Pfizer. All other authors declare that they have no conflicts of interest.

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Home Based Management of Malaria through the BDN (Basic Development Needs) Program in North-East and Eastern, regions of Afghanistan

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Abstract:
Background: Home based management of malaria involves the detection and treatment of cases of malaria at community level and is often coupled with health education, awareness and preventative measures. It has not been tested in Afghanistan, where malaria (predominantly caused by vivax malaria) remains a public health priority. We aimed to test an intervention based on home based management, in the context of the Basic Development Needs program.

Methods: A two-arm pre- and post intervention study was conducted in two rural villages (one intervention and one control) in each of two malaria endemic regions of Afghanistan (4 in total, 2 intervention villages and 2 control villages). The villages were randomly selected and then randomly assigned to the intervention. Prior to the intervention, a baseline survey was conducted to assess baseline prevalence of malaria and knowledge of the community on case management of febrile illness in each selected village.

In the two intervention villages the, HMM strategy was implemented. The intervention consisted of training of local, community based health workers (CHW) and cluster representatives (CR). These were selected by the community and were trained in signs and symptoms of malaria, diagnosis and immediate treatment, as well as referral procedures. The study also employed one lab technician in the intervention communities to provide diagnosis. Following the intervention period (X years), a post intervention survey was again conducted in order to assess differences in prevalence, slide positivity rate and knowledge of disease. In addition, rapid diagnostic tests (CareStart™ Malaria) were evaluated at both laboratory and community level.

Results: Prevalence decreased in all villages, but was most marked in one of the two intervention villages (2.5% vs. 0.1% in the post intervention survey). There were no falciparum malaria cases detected in any village in the post-intervention survey. This same village showed a marked reduction in slide positivity rate as a proxy for incidence. The second intervention village showed no difference from the control villages. ITN coverage increased to almost universal coverage in the intervention village, with household coverage increasing to 93% and >98% of households reporting that all members used the ITN. Baseline coverage was comparable in control and intervention villages at ~60%. Awareness of disease appeared to improve in intervention villages.

Rapid diagnostic tests deployed through CHWs/CRs were not successful, with no cases detected. Sensitivity was 98.1%.

At the laboratory level (where microscopy is available), favourable performance was seen (sensitivity – 100%, specificity – 99.8%).

Conclusions: The study shows impressive results in one of the intervention villages, but similar results to controls in the second. This mixed result is comparable to findings in Africa, where effectiveness has not been convincingly demonstrated. Use of ITNs is improved, and this is an important contributor to the reduction in falciparum malaria. ITN and treatment of acute vivax is likely to have a lower effect, because of relapse episodes within the population.

Use of RDTs at community level did not meet requirements – no cases were detected amongst 360 tests used. At laboratory level, adequate accuracy was demonstrated.
Introduction:

Malaria remains a serious public health problem in Afghanistan. The MoPH has identified 14 provinces which are more at risk of malaria and have the priority for the malaria control interventions. Malaria transmission is seasonal, and most cases are caused by *Plasmodium vivax* malaria (85-95% of cases). The remainder is due to falciparum malaria.

Amongst the main challenges of controlling malaria in Afghanistan is to increase access to accurate diagnosis and effective, prompt treatment. The remote nature of the country, cultural practices and poor security may restrict access to health facilities, and beliefs amongst the population may delay prompt investigation of febrile illness suspected to be malaria.

One potential solution which has obtained prominence is the idea of Home or Community based management. In brief, this program is designed to bring care to patients at local levels with the understanding that it is within communities and households that most cases of fever are recognised and even, in some settings, treated. The initiatives contain various components, usually some or all of: training of community health workers, public health education and awareness, provision of preventative (ITNs), diagnostic and treatment tools, and enhanced referral practices for complicated and severe cases. Some studies have shown the efficacy of this strategy, although its effectiveness has also been questioned \[^{[1]}\].

Most of the evidence of effectiveness comes from Sub Saharan Africa \[^{[1]}\] where mortality, particularly amongst children under 5 and pregnant women, is greatest. The effect of home-based management on mortality has not, however been established \[^{[1]}\]. There is very little evidence from South and West Asia, an area that has a greater population at risk of malaria than Africa.

In Afghanistan, community based programmes currently being implemented in the health sector include the Basic Development Needs programme (BDN). The BDN is an initiative designed to address all the determinants of health collectively through community empowerment in order to transform social lifestyles and enhance human development \[^{[2]}\]. The program is born out of the understanding that health and poverty are interlinked, and that they are mutually dependent. The BDN allows communities to prioritise their needs, and provides them with financial and capacity support in order to take the lead in solving their own problems. This project is conducted, partially integrated, into the BDN program, where communities had identified malaria to be a priority.

We investigated the effectiveness of a community based intervention to enhance home based management of malaria in two malaria endemic provinces of Afghanistan, Nangahar and Kunduz, implemented through the BDN program in villages which had identified malaria to be a major health problem.

The aims and objectives of the project are below:
To evaluate the impact of a new model of home based-management of malaria on the reduction of the malaria morbidity through:

- Active involvement of the community in prevention and control activities at the community level.
- Increasing accessibility of the community to early diagnosis and treatment of malaria.
- Increasing ITN (insecticide treated nets) use in the targeted communities through
community led distribution, health education and community awareness activities.
Increasing community awareness on malaria through the training of CHWs and Cluster representatives.
To evaluate the diagnostic performance of CareStart™ rapid diagnostic test for the diagnosis of vivax and falciparum malaria when used in the community.

Materials and methods:

The study was conducted in four villages, two in Eastern Afghanistan (Nangarhar Province) and two in North-Eastern Afghanistan (Kunduz province). Villages to be included in the survey were randomly selected from a list of villages compiled to areas of “high incidence” of malaria (based on HMIS reports) which are used for rice cultivation, and included in the BDN program.

In Nangarhar province, 2 villages from Behsud district were selected. The incidence of malaria in this area according to the 2006 data of HMIS ranged from 10-15% per year. Around 90% of cases were vivax malaria and the rest was falciparum.

In Kunduz Province, 2 villages of Imam Sahib district were selected. The incidence of malaria in this area according to the 2006 data, was the same as from Nangahar, at 10-15% per year with the same proportion of vivax and falciparum malaria.

Transmission of malaria at both study sites is seasonal; for vivax from May to September, and for falciparum from September to December. The temperature during May to November varies from 30-48°C. The majority of the population in both areas is employed in subsistence and commercial farming.

Ethical approval was granted by the Institutional Review Board of the Ministry of Public Health, and by the WHO-EMRO Ethics Review Board. All participants gave informed consent to participate (Annex).

Study design:

We used an experimental design to implement an intervention study in the selected villages. One village in each region was randomly assigned to the intervention. We conducted a pre- and post-intervention survey in all four villages. The survey consisted of three separate sections.

KAP Survey: Every second household in the selected villages were enrolled in the KAP survey. The survey used a structured, pre-tested questionnaire, translated into local language (Pashto and Dari). The questionnaire consisted of 34 questions (Annex 2). Data collected included information on socio-economic status, knowledge of malaria symptoms and transmission, treatment seeking practices, knowledge of preventative measures.

Malaria Prevalence: A malaria prevalence survey was conducted amongst the sample selected for the KAP survey. Those within the selected household were questioned on the presence or absence of fever in the last two weeks. Those who reported fever, either presently or in the last two weeks had thick and thin blood smears taken. The slides were stained using Giemsa stain. Slides were locally checked at the nearest available facility and were then cross-checked at central level by expert microscopists.

ITN Coverage: Households were also asked about their possession and use of ITNs. Questions on presence or absence of ITN and usage variables were also collected.

Malaria is seasonal in Afghanistan, so we selected the height of the transmission season for both pre- and post- intervention surveys, one conducted in September 2007.
and the second (post-intervention) in September 2008. Following the initial survey, in September 2007, the intervention phase was implemented. CHWs and CRs from the two selected villages were recruited. In addition a supervisor and microscopist were included in the intervention teams. There was no intervention in control villages.

The intervention was designed to include most elements of a community or home based management strategy. It consisted of four components:

Provision of local microscopy services by trained technicians.
Training of community based health workers and Cluster representatives on; case identification, blood slide preparation, case management, referral of severe and complicated cases to the nearest health facility, and preventative measures Community awareness campaigns were conducted to promote awareness of malaria case identification (symptoms), case referral to CHWs/CRs, and prevention.

Provision of free ITNs to all households in the intervention villages.

Those found to be positive for malaria were treated according to national guidelines. Those with confirmed vivax malaria were treated with chloroquine, those with falciparum with Artesunate/fansidar. If a case was suspected outside the operating hours of the microscopist, they were given presumptive treatment with chloroquine and fansidar and referred for diagnosis the following day.

The number of cases of malaria during the period September 07-September 2008 was also monitored. For intervention villages, this was recorded according to the diagnosis of the village microscopist which was noted in register books. For control villages, incidence was determined through the continuous recording of episodes and cases by HMIS system for the health unit that serves the control village. The health units cover additional villages to the control village and the catchment population is unknown. This does not allow for comparison of the incidence of malaria but we used a proxy - slide positivity rate (total number of case / total number of slides examined.

The post-intervention survey followed the same procedures as the pre-intervention survey, and was conducted in the same households as the pre-intervention survey.

Training of Field Workers:

Two, one day training sessions were conducted in the provincial NMLCP centres and 41 CHWs/CRs were trained as surveyors for the two targeted areas at baseline and for the impact evaluation surveys. The training aimed to orient the intervention group in NMCP guidelines, malaria diagnosis, treatment and prevention of malaria.

Evaluation of RDTs:

The performance of RDTs for the diagnosis of falciparum and vivax malaria was evaluated by comparing the results of RDTs with microscopic examination of blood during the study period. This evaluation aimed to examine the effectiveness of RDTs under operation conditions employed either at health worker (community level), or at laboratory level in intervention villages. Three CHWs/CRs were selected from intervention villages for the first evaluation. These were given one day training on the theory and practical use of RDTs. The
curriculum was developed between WHO and the NMLCP. WHO provided ToT training for NMLCP supervisors and the principle investigators. They were given materials on RDT use and malaria treatment. Each CHW was provided with 60 RDTs for use at their discretion. If a CHW/CRs used an RDT in the field, they were also asked to collect a blood slide and note the result of the RDT. The slide was then taken to the village microscopist. The slide was read and the result of the slide reading noted. In the second phase, the microscopist administered the RDT alongside the blood slide when the patient was referred for diagnosis by the CHW/CRs. The microscopist took both a blood slide and conducted the RDT. All slides were cross checked by central-level expert microscopists at the NMLCP reference laboratory in Kabul.

Results:
Overall prevalence of disease in the pre intervention survey differed between control and intervention villages (0.6% vs. 1.7%, respectively \( \chi^2 = 23.8, p<0.001 \)). In the intervention villages, a reduction in malaria prevalence of 93.5% was noted between the pre-and post-intervention surveys (1.7% vs. 0.1%, respectively \( \chi^2 = 53.8, p<0.001 \)). In control villages, a 50.0% reduction in malaria prevalence was noted (0.6% vs. 0.2%, respectively \( \chi^2 = 10.0, p=0.002 \)). Prevalence therefore reduced in both intervention and control villages, probably due to normal annual variation and the recently implemented ITN programme. However, in the intervention arm, reduction in prevalence was almost double that of the control group (93.0% vs. 50.0%) (figure 1).

The reduction in falciparum malaria in both intervention and control arms was absolute, with zero cases reported in the post-intervention prevalence survey at any of the study sites. The reduction in vivax malaria was less marked in the control villages vs. the intervention villages (39.4% vs. 93.1%) but still dramatic. When viewed by village, the majority of the reduction effect comes from the reduction in the Northern Intervention village of Aqmasjad (Figure 2). The reduction in the second (Eastern) intervention village is comparable to those in the control group. No cases were detected in the intervention village in the East, or in the Northern control

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**Figure 1: Prevalence of malaria in intervention and control villages at the pre and post survey**
village (Koldaman) at the post-intervention survey.

Figure 2: Prevalence of malaria in control and intervention villages pre- and post-intervention.

Those who self-reported malaria in the last two weeks also reduced in both the control and intervention villages. However, there was a greater reduction in the intervention villages than in the control villages. Because denominators (population under coverage, and usage) are uncertain for control villages (who used local public health services), it is not possible to make comparisons of incidence of disease over the course of the project. However, as a proxy for incidence, we examined the slide positivity rate (number positive slides / total number examined). This measure gives the proportion of all blood smears which are positive. As malaria incidence falls, the proportion of febrile illness attributable to malaria will also fall. By this measure, one of the intervention villages (Aqmasjad) performed better than the control village (Abdian) and the second intervention village (Miran). Since microscopy services were unavailable at Koldaman (the second control village), it was not possible to include this data (figure 3). Aqmasjad is the intervention village from the same area as Abdian, the control village. The disease trend in Abdian is typical of the pattern seen in Afghanistan. Incidence (SPR) peaks twice in the year, once in Autumn (Sept-November) and once in the summer (April-July). This trend is not seen in Aqmasjad, where the peaks appear to be tempered. The intervention village of Miran shows an almost identical trend as the control village (although they are in differing regions).
The coverage of insecticide treated nets increased in the intervention villages. In control villages ITN household coverage remained similar (67% vs. 60%), while a 33% increase was noted in the intervention villages (60 vs. 93%) (Table 1). Changes in usage patterns were also evident in the intervention group, with 89% reporting that all family members use an ITN in the household (Table 2).

Table 1: % of households with at least one ITN in the house

<table>
<thead>
<tr>
<th></th>
<th>pre-intervention</th>
<th>post intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention group</td>
<td>Control group</td>
</tr>
<tr>
<td>Yes</td>
<td>60.30%</td>
<td>347(65.84%)</td>
</tr>
<tr>
<td>No</td>
<td>39.70%</td>
<td>180(34.16%)</td>
</tr>
<tr>
<td>Total N</td>
<td>534</td>
<td>527</td>
</tr>
</tbody>
</table>
Participants also reported enhanced knowledge of treatment seeking. In intervention villages, those who would seek treatment within one day of symptoms increased from 22.7% to 59.3%. In control villages, the rate was high in the baseline survey, but remained constant (60% vs. 60%). Because of better referral for investigation by health workers, diagnosis and treatment in the community by HMM team decreased in post intervention survey. Diagnostic practices seemed unchanged between the control and intervention villages, even though diagnostic services were provided and enhanced in intervention villages (Table 3).

### Table 3: How was the case diagnosed?

<table>
<thead>
<tr>
<th></th>
<th>pre-intervention</th>
<th>post Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Clinical</td>
<td>112</td>
<td>27.32%</td>
</tr>
<tr>
<td>Microscopy</td>
<td>294</td>
<td>71.71%</td>
</tr>
<tr>
<td>RDT</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>410</td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic performance of RDTs:

In total, 2296 CareStart™ Malaria [Access Bio, Inc., pLDH (PAN)] were evaluated between November 2007 and July 2008. This test is designed to distinguish falciparum malaria, other species of malaria (pan-specific) and negative results (showed by the control line) (figure 1). Results of blood slides were cross-checked against double-read laboratory slides as the gold standard. Three hundred and sixty RDTs were deployed to CHWs in the field. Of these, zero diagnosed a case of malaria, although did show 1.9% false positive rate (sensitivity; 98.1%), and zero false negatives. Because no true positives were detected either by RDT or microscopy, sensitivity cannot be calculated.

The remaining RDTs (n=1936) were deployed in laboratories which provided microscopy. They were not deployed amongst CHWs and CRs because it was clear that they were not being used correctly. The laboratory deployed RDTs had a sensitivity of 100% and specificity of 99.8%.
Conclusions and Discussion:
Impressive results at reducing malaria were achieved in one out of the two intervention villages (Aqmasjad), as measured by the pre- and post-intervention prevalence survey and the analysis of slide positivity rate. The results in the second intervention village (Miran) were comparable to the control villages. This is likely to reflect differing implementation methods in the two villages. It is not clear from this data whether implementation through the BDN brings additional benefit over implementation through the formal health sector (i.e. community health workers). The Cluster Representative (CR) fulfils a similar role and could be seen as an adjuvant to the current CHW network.

The fall in falciparum malaria was absolute; there were no cases in any villages in 2008. This is likely to be a factor of improved access to treatment and the high coverage of ITNs in both intervention and control villages. The effect of improved access to treatment and high ITN coverage on vivax is less pronounced because of the incidence of relapse episodes caused by the activation of latent hypnozoites in the population. Augmentation of the effect could be achieved by use of anti-relapse therapy.

ITN coverage and usage was improved by this survey. This is not a surprising result and adds to the argument for free distribution as a tool for rapidly increasing coverage. Knowledge attitudes and practice appear to have improved by this analysis. Patients treatment seeking was improved in the intervention villages.

The RDT evaluation showed mixed results. According to the field investigators, the use of the RDTs by CHWs/CRs was not appropriate, despite training. No single case of malaria was detected using 360 tests in the field. However, when evaluated in the laboratory (alongside microscopy), cases were detected and the performance of the test was confirmed as adequately accurate under these conditions. The decision to deploy RDTs at community level is therefore not assured and requires greater thought and a carefully conceived operational research program. They are likely to play a role in increasing access to diagnosis but most likely will be useful where diagnostic facilities are currently lacking. A blanket approach to deployment is likely to be expensive and may not have the health effects required to merit their use in all settings.
The evidence in this study has shown that CHWs and CRs could provide appropriate case management for malaria. This finding provides evidence that a scaling up of the HMM strategy in the community might contribute to reducing malaria morbidity at community level. However, the cost effectiveness of the strategy, in terms of cases prevented, requires evaluation. It is likely to be sensitive to incidence of malaria - in areas with higher transmission it is likely to be more cost effective. This criteria is not met in this region, where prevalence and incidence is low. Any community based initiative should therefore be targeted at fever treatment, including IMCI guidelines, to have a greater health effect - the majority of fever detected in this survey (and confirmed in most other prevalence and incidence surveys) is not caused by malaria. Provision of treatments for malaria and for non-malarious causes of fever where referral is not possible, therefore, is likely to be the optimal strategy for improving health outcomes.

**Recommendations for policy:**

This study does not provide strong supporting evidence that the HMM strategy (as implemented in this study) contains additional benefits over currently available disease control strategies. It is not possible to conclude that the reduction in prevalence seen in one of the intervention villages is as a direct result of the implementation of the HMM program, or due to extraneous factors (for example, increased ITN use or general improvements in the health services and access to them). It is also not possible to examine the effect of the different components of the HMM program (health education, CHW/CR education, ITN distribution, community based diagnostics, enhanced referral). Further research is needed to examine whether HMM strategies are cost-effective and desirable in a context where malaria is not the main cause of febrile illness. The results of this study are not conclusive and larger studies using a cluster randomised design would be desirable.

The use of RDTs in the community does not appear effective, since no cases were detected out of 360 deployed by CHWs and CRs. Patients generally sought treatment for fever in the health service even when RDTs were available at the community level. For this reason, it is doubtful whether RDTs will have a great role to play at community level in the future. Certainly, further research is warranted to examine the role of this intervention, in three separate aspects - at what level of the health service is it worthwhile deploying RDTs? What proportion of those who have an RDT then go on to higher levels of the health service and have an additional diagnosis? What proportion of users and patients take anti-malarial drugs even in the presence of an RDT negative result? Prior to national scale implementation of these potentially useful tools further operational research is needed.

ITN coverage through free distribution by CHWs increased the level of coverage, Care needs to be taken to ensure that any community intervention aimed at increasing coverage of ITNs is coordinated with national programs.

In conclusion, this study provide poor evidence of effectiveness to warrant national level implementation of an HMM system. Further research is required.
References:


Adherence of the private sector to the national malaria control program guidelines in diagnosis, treatment and reporting of malaria patients

Khalil Ahmad Kohistani, Kathy Fiekert, Toby Leslie

Abstract
A study on "private sector adherence to the National Malaria Control Program (NMCP) guidelines in diagnosis, treatment and reporting of malaria cases" was conducted in 15 provinces (14 high risk malaria and one epidemic prone province), to evaluate the impact and adherence extension of private sector (medical doctors and lab technicians) on the national malaria control guidelines in diagnosis, treatment and surveillance of malaria as follows:

Methods:
The understudy groups both consisted 10% each section of health care providers of provinces totally 189 participants (117 medical doctors and 72 Lab technicians) were selected randomly. One day workshop was held to increase the knowledge and orientation skill of surveyor group in Adherence of private health care providers on NMCP guidelines in diagnosis, treatment and their collaboration in NMCP activities. The levels of knowledge, attitude and practice of both groups were assessed at the time of intervention by a questionnaire with 50 opened questions and an evaluation checklist with 15 assessed behavioral items were designed and used to assess the knowledge and range of their active participation. The 15 surveyors after getting orientation sent to 15 targeted provinces for interviewing and orientation of PHCP. The surveyors monitored and supervised by principle investigator and NMLCP Director.

Results and conclusions:
There was a suboptimal level of knowledge regarding NMCP guidelines in diagnosis, treatment and also reporting of malaria cases in both groups during the intervention. However, the study also indicated great interest by private service providers to participate in the NMCP. The study has shown that there is needed to make plans for increasing the knowledge of PHCP and better define their role in the NMCP.

Introduction

Objectives

The general objective of this study is to evaluate the extent of adherence of the private health care providers to the national malaria control program guidelines in diagnosis and treatment of malaria patients. Furthermore it seeks to assess the extent of collaboration of the private Health Care Providers in reporting and referring of malaria cases, where necessary, to the national control program.

The specific objectives of this study are to

1. ascertain the knowledge level of the private sector regarding their role in the malaria control program in Afghanistan
2. assess their attitude regarding their participation in the malaria control program in Afghanistan
3. Confirm their actual current role and level
   a. in participation in malaria diagnosis,
   b. in performance
   c. in data collection
   d. in other related services

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Introduction:

The rehabilitation of Afghanistan’s health system is now well underway. So far efforts are mostly concentrated on the public sector system, administered by the MoPH and implemented by range non-governmental organizations (NGOs). Several surveys have attempted to evaluate the use of the private sector in health care provision. The use of the private sector is considered to be high, and out of pocket expenditure on private health care reportedly one of the highest in the world, as a proportion of per capita income (Seuters, 2004, Unpublished report). Despite this, very little is known about the quality of care available in the private sector and there is almost no meaningful regulation.

There is now a national policy framework for malaria control (the National Malaria Strategic Plan) which is administered and overseen by the National Malaria and Leishmaniasis Control Program (NMLCP) with support from a range of partners. Of concern to the NMLCP is the role played by the private sector in malaria control – a role that is seen as vital to the success of the disease control strategy, given the high use of this sector and the gaps in the developing public sector. Despite this aim, relatively little is known about the current practice and role of this sector.

The NMSP calls for the private sector to be actively participating in national malaria control efforts. The plan calls for the inclusion of this sector in all disease control efforts. The first stage of such inclusion is to evaluate current practices and procedures in diagnosis, treatment, and disease reporting. The eventual aim of the process is to develop and implement an accreditation scheme for private sector practitioners. This will provide guidelines on “best practice” which will be a minimum standard of care available through the private sector. Practitioners will undertake training and assessment and be certified as “malaria specialists”. The scheme will be coupled to public awareness campaigns advising the public to use malaria specialist private sector facilities.

Materials and Methods

Study Area and Population:

The study was conducted in 15 provinces in Afghanistan1 (Map). These areas were chosen on the basis of known malaria endemic, with the exception of Bamyan which was chosen as an epidemic prone province. Other than Bamyan, the remaining provinces are classified as high risk for malaria, based on surveillance data. Participating private sector units were selected from a list of facilities provided by the provincial MoPH. The sample was a convenience sample which aimed to include 10% of the listed clinics in each province. At each facility the clinic doctor was asked to participate in the survey, and gave informed consent. In addition technicians were also asked to participate in the same way – a random selection from a MoPH list.

1 Bamyan, Laghman, Kuner, Faryab, Herat, Kunduz, Takhar, Baghlan, Badghis, Balkh, Nangerhar Khost, Kandahar, Helmand and Badakhshan

Questionnaire Survey:

The questionnaire (Annex-1) was designed to answer the aims and objectives of the survey. As such it asked questions about the malaria situation in the province (transmission season, case load, etc);
referral practices; reporting practices; and opinions on their involvement with national control efforts. Additional data was collected on the practice history and qualification of each participant. The questionnaire was pre-tested on a small sample of physicians in Kabul. Surveyors were trained in the study methods, and questionnaire administration prior to the start of the study. The data was double entered into Epi-Info (CDC, Atlanta, GA, USA), and analysed using the same software. Results were copied into Excel (Microsoft, USA), and used for the preparation of the report.

Results

Private practitioners:

117 doctors agreed to participate in the study and were interviewed. If one doctor declined to participate another was chosen in his place.

Participants:
Seven (6%) interviewees were female and 110 (94%) male. The Age of the interviewees (n 117) ranged from 25 to 71. The mean age was 39.7 years (SD 8.4) with the median lying at 38 years. 25.6% were between 25 and 34 years of age, 45.3% between 35 and 44, 24.8% between 45 and 54, 3.4% between 55 and 64, and 0.9% above 65 years.

Twenty-two (19%) worked for less than 5 years in their profession and 94 (91%) for over 5 years. One 26 year old and two 28 year olds claim to have worked as MD for more than 5 years, which calls either their answer or their actual qualification into question, since the medical training in Afghanistan takes 7 years after the completion of high school (which finishes at 18 years of age). Therefore the youngest age at which a medical doctor can start practicing is 25 years. 98 (83.8%) received their official permission for private practice from the central MoPH, and 19 (16.2%) received this permission from the provincial MoPH. 95 (81.2%) stated that they hold an official job next to their private practice activities, compared to 22 (18.2%) who receive their sole income from their private practice. Of the 95 with additional employment 80 (84.2%) work for the government and 15 (15.8%) work for NGOs.

The number of days that private service providers worked in their own clinic (n114) varied from 4 to 7 days with a mean of 6.3 days (SD 0.5757) and a median of 6 days. 40 (34.2%) of the interviewees see their private practice as a service to the people, 17 (14.5%) state economical reasons for their private practice and 60 (51.3%) claim both as their motivation. The perceived mean catchment population was 157,000 (SD 280,000) ranging from 1000 to 1 million population with a median at 50,000. As the below table shows 109(93.20%) of private medical doctors were ready to participate in malaria control programs.

| Can you participate in malaria control Frequency Percent 95% Conf Limits |
|-----------------------------|-------------|------------------|
| Yes                         | 109         | 93.20% ± 87.00%  |
| No                          | 8           | 6.80% ± 3.00%    |
| Total                       | 117         | 100.00% ± 100.00%|
**Malaria Specific Data:**

Of 116 responders 60 (51.7%) reported to have attended one or more malaria refresher courses. 113 responders reported to see between 1 to 1200 malaria suspects per month with a mean of 126 (SD 189.1583) and a median of 60. 111 reported to have seen between 0 to 300 malaria cases in the previous month with a mean of 47.9 (SD 67.8852) and a median of 17. Of the 117 interviewees 78 (67.8%) would use blood examinations to diagnose malaria, 5 (4.3%) would diagnose malaria clinically, and 32 (27.8%) would use both methods.

17 (14.5%) would send patients to nearby public sector health facilities for confirmation, 91 (77.8%) would use private labs and 9 (7.7%) stated to use both. 111 (94.9%) stated that their nearby health facility had laboratory facilities capable of performing malaria confirmatory tests. 115 (98.3%) stated to treat malaria cases in their clinic. Of these 113 answered the question about treatment regimen used. 63 (55.8%) claim to follow the national protocol of the NMLCP and 50 (44.2%) stated to use other treatment regimens.

Of the 115 who treat malaria 83 (72.2%) claim having a follow up system for Pf cases. Of 85 responders who follow up on Pf cases, 73 (85.9%) call them in for 1-2 times and 12 (14.1%) call them for 3-5 follow up visits. Of the 115 who are treating malaria patients only 32 (27.8%) report cases to the MoPH with 83 (72.2%) not reporting. Out of the 117 responders only 36 (30.8%) received at least one supervisory visit from a MoPH representative in the past while the remaining 81 (60.2%) never received any such visits. A statistically significant relationship was demonstrated between private service providers receiving supervisory visits from the MoPH and their adherence to national treatment guidelines. 25/ 34 (73.5%) of practitioners who received supervisory visits claimed to use the national protocol compared to 38/ 79 (48.1%) with a chi2 corrected (Yates) of 5.2421 (p=0.0220).

The table below shows the self-perceived importance of the private sector to malaria control:

<table>
<thead>
<tr>
<th>Role of the private sector in malaria control programs</th>
<th>Frequency</th>
<th>Percent</th>
<th>95% CL</th>
</tr>
</thead>
<tbody>
<tr>
<td>highly important</td>
<td>33</td>
<td>28.2%</td>
<td>20.3% to 37.3%</td>
</tr>
<tr>
<td>important</td>
<td>52</td>
<td>44.4%</td>
<td>35.3% to 53.9%</td>
</tr>
<tr>
<td>less important</td>
<td>10</td>
<td>8.5%</td>
<td>4.2% to 15.2%</td>
</tr>
<tr>
<td>medium</td>
<td>16</td>
<td>13.7%</td>
<td>8.0% to 21.3%</td>
</tr>
<tr>
<td>not important</td>
<td>6</td>
<td>5.1%</td>
<td>1.9% to 10.8%</td>
</tr>
<tr>
<td>Total</td>
<td>117</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>
When asked about restrictions to the use of anti-malaria drugs, 36/117 (30.8%) of responders felt that anti-malaria drugs should only be available in the government/public sector, whereas 81 (69.2%) thought that these drugs need to be available in the public and private sector.

95/117 (81.2%) believe they could have a positive role in supporting the malaria surveillance system of the country. Out of these 79 (83.2%) thought they could participate in data reporting, 15 (15.8%) offered to provide outbreak information, and 1 (1.1%) stated other roles. 109 (93.2%) were willing/able to participate in malaria control activities of the NMLCP.

However, when asked later if they would agree to co-operate with the NMLCP for malaria control activities in the future, 114 (98.3%) said that they would. 78 (68.4%) would expect to receive support for their participation, whereas 36 (31.6%) stated not to expect support. Of 78 who expect support for their participation 35 (44.9%) expect both financial and technical support, 13 (16.7%) expect financial support only and 30 (38.5%) expect only technical support.

Out of 117, 108 (92.3%) advise slide examinations for all febrile patients, while the remaining 9 (7.7%) would advise slide examinations for all febrile patients and referred malaria suspects. 84/117 (71.8%) would refer some malaria cases to hospitals. Of these 27 (23.1%) would refer comatose patients, 36 (42.9%) seriously ill patients, 12 (14.3%) treatment failures, 8 (9.5%) febrile cases, and 1 (1.2%) stated other reasons.

**Private microscopists**

72 private microscopists/lab technicians were interviewed for the study. 90% were male. The mean age was 37 years. 36% held a baccalaureate degree (i.e. finished high school), 47% held a technologist certificate/diploma, 6% were MDs and 11% stated other education levels. Most (72%) had worked for more than 5 years. Only 13% worked without official permission. In reality this number is probably higher – the selection criteria for this study were to use a list from MoPH to identify participants. Most (78%) hold an official job next to their summer. 90 (87.4%) placed it in the autumn, which is partially correct, since the malaria season stretches from June to November, and such there are still many cases seen in autumn. 2 wrongly identified the winter as the peak in the Pf transmission. Out of 112 responders 5 only (4.5%) correctly identified the autumn as the peak season for Pf. 104 (92.9%) identified the summer as the peaks season for Pf, and 3 (2.7%) even thought it would be spring.

To assess their general knowledge about malaria the interviewees were asked about the malaria peak seasons in their area, when they would advise slide examinations for malaria, and about referral of malaria patients to hospitals. 103 responders answered the question on Pv peak season, with 11 (10.7%) correctly identifying it to be
private practice. Out of the 56 with official employment, 80.0% work for the government and 20% for NGOs. Asked for reasons to operate private practice, 50% stated both economical reasons and the desire to provide a service for the people, 28% for economic reasons alone, and 22% only out of a desire to provide a service for the people.

Technicians see an average of 200 slides per month (range: 8-1500), with a slide positivity rate of 10-30% reported by the majority of respondents (80%). This SPR is in line with previous experience. Most (>90%) work for 6 or 7 days per week. 80% believe malaria to be a serious public health problem, and 97% report a willingness to be involved in malaria control. 94% would like to have cross-checking (quality assurance) provided for them, although only 50% keep the slides that they use for diagnosis. 50% report having had a supervisory visit from MoPH staff. All participants would take part in malaria surveillance and 58% have a malaria register.

On diagnosis, the practitioners report that only 58% conduct both thick and thin smears (the gold standard). 35% perform only thick smears and 7% only thin smears. Thick smears are accurate at diagnosing the presence of parasites, but are less effective for speciation of the infective organism. Since different treatment regimens are recommended for vivax and falciparum malaria, it is important to have accurate speciation. Most (>90%) use Fields of Geimsa stain. 40% have attended more than 2 malaria microscopy refresher courses and 33% have attended 1-2 courses. 26% have attended no such courses. There appears to be no correlation between having an "official job" and training – 75% of those with and those without official jobs have attended training. This shows that, where available, training courses are well attended by private sector practitioners.

As the below table shows 70(97.20%) of private lab technicians were ready to participate in malaria control programs.

<table>
<thead>
<tr>
<th>Can you participate in malaria control</th>
<th>Frequency</th>
<th>Percent</th>
<th>95% Conf Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>70</td>
<td>97.20%</td>
<td>90.30%</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>2.80%</td>
<td>9.70%</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

**Discussion**

Broadly speaking, this data show that private sector practitioners are familiar with malaria treatment, diagnosis, and referral. The majority claim to administer blood analysis on all febrile patients for diagnosis, either in their own clinics or in private facilities nearby. This shows an informal referral system is in place, and can be built upon.
Practitioners treat patients in the clinics, meaning that there is no delay in administering treatment. In addition, clinics are open at times when government centres or not, providing increased accessibility. However, only around ½ of respondents reported using the national malaria treatment guidelines (via self-reporting, so this is likely to be an over-estimate). Further investigation is required to assess both the type and quality of drugs on offer in these facilities. Adherence to the national guidelines will ensure optimum treatment outcomes (since the policy is based on good evidence from large, recent trials), and prevent the spread of resistance through the use of artesunate combination therapy (ACT) for falciparum malaria. Assessment of the quality of drugs on offer is essential, since it is believed that counterfeit and poor quality drugs are widely used, albeit unwittingly, in the private sector. The inclusion of the national guidelines in training is imperative. The supply of ACT and other quality assured drugs to the private sector and through the private sector will require wide ranging regulation of what is a largely lawless industry in the South Asia Region. This will undoubtedly be outside the scope of the NMLCP and its efforts to include the private sector in malaria control. Efforts will need to be made, as a matter of urgency, to assess the scale of the problem and involve a wide range of stakeholders (including the industry itself) in formulating regulatory policy. In order to ensure quality drugs in the interim, a purchasing scheme could be introduced for practitioners to gain access to a supply of quality assured drugs, at cost price.

Reporting of malaria cases to MoPH is low, despite the relatively high number of patients being seen at most of the clinics. It seems likely that the estimate of malaria case load in Afghanistan is poor, considering the number of persons who attend the private sector, which is largely unreported. Previous estimates of malaria case load should be re-evaluated based on surveillance data including hard reporting from the private sector. Clinics should be given pro-forma disease surveillance reporting forms and asked to participate by submitting weekly or monthly reports. This will require active participation on the part of the NMLCP and provincial health authorities to ensure sustainability and compliance.

The majority of private doctors questioned signaled their interest in being involved in malaria control at a national level. Some reported that they had been trained, although very few reported monitoring visits from government representatives. This willingness to be included in national efforts is encouraging and provides useful information on the participation to be expected from this sector. This conclusion is confirmed by the motivation for providing services – the majority state that provision of services to the population and economic reasons provide the incentive to practice.

Some evidence is provided on the effectiveness of training and monitoring
visits – those who had been trained or received visits were more likely to report using the national treatment guidelines. This is evidence that approaching private practitioners can have the desired effect. The majority of practitioners would require some support for inclusion in national disease control efforts. Since the respondents are motivated by service provision and economic reasons, it seems likely that providing an incentive for inclusion in training and accreditation would be along these lines – free training (with the usual per diems, etc) to improve service provision, coupled with accreditation and certification can provide both these incentives. The economic incentive will come from the certification of practitioners making the demand for their services increase. Piloting of such a scheme with quality and economic assessment will be required.

Amongst diagnostic technicians, the majority are motivated by economic reasons, suggesting that inclusion of this group will require a greater degree of economic motivation. A large proportion of technicians report that also have official jobs. This is in line with anecdotal evidence which suggests that many publicly employed informal health workers also run private practices to top-up their income. A relatively large proportion of practitioners (around 73%) reported some type of training. Although this number matches the proportions who are employed in “official jobs”, there is no relationship between training course attendance and those who hold “official jobs” individuals trained in the public sector (i.e. by NGOs/MoPH) also benefit the private sector.

Methodologically, the study is lacking in certain areas. Reporter bias is always a major concern in self-reported studies, and the absence of hard, verifiable, data in the questionnaire may impede its reliability. Nevertheless, the results of the survey do provide useful evidence for the formulation of a system which embraces the private sector into national malaria control efforts. A system of accreditation and certification should contain certain key elements. In designing such a system policy makers will need to consider the following:

- A clear incentive to participate in such a scheme
- A public education and awareness scheme to sensitize the public to the certification
- Good quality training which is repeated at intervals
- Updates on technical issues and changes of policy communicated to participants
- Monitoring and evaluation of performance.

Such a system must also be participatory, and should involve consultation with the private sector from the outset. If this is not a key component, it is unlikely that the system will succeed.
Conclusions

1) Private practitioners are willing to be included in NMLCP disease control efforts.
2) Training of private practitioners is effective
3) Private practitioners are familiar with malaria treatment, diagnosis and referral
4) Currently, knowledge and adherence to National Treatment Guidelines is poor, and a range of drugs are used in treatment.
5) Reporting of malaria cases is low, and requires urgent attention, although practitioners are willing to participate.
6) Private practitioners are receptive to government run training schemes, and often these courses conducted for public sector workers cover the private sector as well.
7) Many practitioners (physicians and technicians) also work in the public sector.

Recommendations for policy:

Based on these findings, the following measures can be recommended to improve the standard and level of involvement of private sector practitioners in Afghanistan:
1) A formal training and accreditation scheme (TAS) needs to be designed and conducted as a pilot interventions. This is to include:
   • Basic malaria and its control
   • Diagnosis (include RDTs) and treatment according to national guidelines
   • Health education
   • Reporting and disease surveillance.

A comprehensive and concise curriculum needs to be developed, in collaboration with private sector representatives. This intervention can be conducted through Malaria Reference Centers and supervised by the NMLCP and its partners. After training and accreditation, practitioners are to be given a certificate for display. This will inform the public that they are trained to the TAS standard as malaria specialists. The TAS should be accompanied by a public awareness campaign. Outcomes should be measured according to specific objective indicators, and after a review this scheme can be brought to scale.

2) Secondary to the TAS a system of service quality checking and re-training should be conducted.

3) A quality assurance scheme for antimalarial drugs should be employed to ensure treatment unity and the possibility of a purchasing scheme considered.
4) A case reporting scheme needs to be piloted in the private sector with over site by local health authorities and the NMLCP.
Assessment of the Present Role of the Private Sector in Malaria Diagnosis, Treatment and Control in Afghanistan, 2008

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Abstract:
Introduction: The private sector is an under-studied entity in Afghan health delivery. Most studies agree that it is a provider of service to a large proportion of the Afghan population. In malaria control, there is very little data on this sector, and this is the focus of this study. The private sector presents some significant risks to current malaria control efforts. An effective policy of engagement and service improvement will rely on evidence if these risks are to be turned into opportunities.

Amongst these threats are poor treatment practices and outcomes, which may propagate drug resistance or poor quality drugs through uncontrolled service provision, expensive services, non adherence to policy guidelines, and lack of quality control. The private sector also presents opportunities for improved practice and service provisions, if correctly approached. Since it is a considerable service provider, efforts to improve services through the public sector alone are unlikely to have the optimal effects on malaria control, since a large proportion of the community do not readily access these services.

A survey of the private sector was conducted from October 2007 – August 2008 in three malaria endemic (risk-strata 1) provinces in Afghanistan (Laghman, Baghlan and Takhar). The aim of the survey was to gain an understanding of private sector use, service provision and cost in order to inform policy and assist in devising initiatives to include the private sector in malaria control.

Methods: Three surveys were conducted in order to gain a broad understanding of private sector use and service provision. The surveys were designed to assess user and provider practices.

1. Household Survey: A household survey enrolled randomly selected households in order to identify determinants of fever in households, estimate the proportion and determinants private sector use and to estimate costs of fever episodes.

2. Facilities Survey: A facilities survey was conducted to identify current practices at randomly selected private sector facilities. These fell into three categories – clinics (providing consultations), laboratories (providing diagnosis), and pharmacies (providing treatment). Information was collected on education, length of service, quality and range of services, willingness to participate in malaria control initiatives and quality improvement schemes. Cost of services were also assessed.

3. Exit Surveys: At facilities providing consultations, exit interviews were conducted using a convenience sample of users to assess perceptions, cost, and reasons for visiting each facility.
Results:

1. Household survey: A total of 1,776 households were enrolled in the survey from 8 villages in the three provinces. Fever in the last 6 months was associated with socio-economic quintile, and the risk of fever varied by province. Those keeping animals at home and collecting water from rivers and ponds were also at elevated risk. ITN use was protective against fever. Of all fever cases, >90% sought treatment, although this differed by province and age of the patient. Of those who sought treatment, 44% did so in the private sector, most of whom presented at private clinics. Seeking treatment in the private sector was more frequent in the highest socio-economic strata. Out of pocket expenditure in the private sector is about three times that of the public sector (median cost 430 AFG vs. 155 AFG, respectively), with the cost of drugs being dominant. More than 50% of all users (public and private) reported problems with making payment (borrowing, selling or with severe consequences), and this was higher in the private sector and in the poorest. Users were generally satisfied with the level of service in both sectors, although it was higher in the public sector. Most reported use of the private sector for the reason of better quality.

2. Facilities survey: In total 353 private sector facilities were enrolled with 173 practitioners, 85 laboratories and 95 pharmacies:
   - Practitioners Survey: Most facilities treated malaria, and almost all reported that they refer febrile patients for diagnosis. Almost all recognised that chloroquine was the correct treatment for vivax malaria, but only one facility correctly identified fansidar/artesunate as first line treatment for falciparum malaria. Sixty percent of practitioners also worked in the public sector. Most would be willing to take part in training and record keeping. Almost all (80-90%) of those who stocked drugs had chloroquine and fansidar, and 40% stocked quinine.
   - Laboratories Survey: Almost all facilities diagnosed malaria, although fifty percent of laboratory workers had no formal training. Very few had any quality assurance system for microscopy. Some clinics reported stocking rapid diagnostic tests (8.2%), although most would not believe the result. Almost all would participate in training and most agreed to regulation through monitoring and quality assurance. Very few provide G6PD testing.
   - Pharmacies survey: Most pharmacies would give antimalarials on the basis of a prescription or diagnosis and few (8%) would give them if requested without prescription or diagnosis. Knowledge of national treatment guidelines mirrors that of practitioners. For undiagnosed fever, 6% say they would give an antimalarial, with most giving an antipyretic. Few had attended training, although willingness to participate was high. Drugs were primarily supplied through wholesalers and local bazaars.

3. Exit interviews: Users (n=514) enrolled at private sector clinics presented for a range of symptoms, most common amongst them being fever, headache and body-pain. The principle reason for use of the facility and the private sector as a whole was the quality of service. Most were prescribed drugs, and of those with fever, 22% were given antimalarials, and 33% were referred for diagnosis (although it is unclear if diagnosis was sought before presentation). Forty percent were given antibiotics. Median cost of the illness was 540 AFG (USD 10.8). Costs differed by province, matching the finding of the household survey.

Conclusions: Most people seek treatment for fever. Use of the private sector for service provision in febrile illness was high with most seeking treatment at clinics rather than laboratories, pharmacies and other sources. Out of pocket expenditure was also high. Quality of service (or the perception of service quality) was the main driver of use of the private sector. The economic burden of private sector use is high, and those in the lowest socio-economic groups are at greater risk of disease.

Diagnostic quality may be low; very few laboratory workers had had formal training and few, if any, had a quality control system. Treatment practices for vivax malaria conform to national guidelines, but use of artesunate combination therapy for falciparum malaria remains very low. Training levels were low in all facilities, although willingness to be trained was very high. Willingness to participate in other initiatives was relatively lower, although the majority agreed to some form of regulation.
The study shows that there are many opportunities for inclusion of the private sector in malaria control initiatives and significant gains to be made by their inclusion. Recommendations for enhancing service provision in this sector include shifting demand amongst by changing expectations; provision of training at all levels; enhancing quality of diagnosis; development of national treatment guidelines for the private sector; including the private sector in disease monitoring; and conducting further research based on the findings of this study. Any policy will require pilot testing and careful evaluation.

A well made policy for the private sector has the potential to improve services to a large proportion of the population. This can be seen, therefore, as a vital component of malaria control, especially with a view to elimination or eradication of disease.

**Introduction:**

The private sector represents an under-studied sector in healthcare delivery in much of the world. The realisation that this sector has the potential to reach large numbers of people in low income countries makes this an attractive option for improved service delivery. Within the realm of malaria control, the private sector may have a significant role to play; many people seek treatment of fevers at an array of facilities. Initiatives to provide improved services through this sector are now reaching global prominence, for example through the Affordable Medicines for Malaria initiative which aims to provide subsidised artemisinin combination therapies (ACT) through the private sector, primarily in Africa. On the contrary, the private sector presents a number of threats to malaria control if it remains unregulated. Information is needed in order to devise appropriate strategies to improve service provision in this sector.

All estimates of private sector use in Afghanistan suggest that it is a significant source of service provision. Although estimates of usage rates vary, all agree that the proportion of people who preferentially use the private sector is substantial. Improvements in the public sector, and in particular healthcare that is free at the point of use, may attract users from the private sector but the perceptions (and realities) of quality in the public sector act as a driver in the opposite direction. It is unlikely, in the foreseeable future, that the public sector in Afghanistan will succeed in attracting the majority of patients to its doors. Even if this were the case, facilities are likely to become overwhelmed with a consequent loss of quality and public confidence. Improvements in the public sector aimed at malaria control (such as improving diagnostic access and effective treatments) are therefore likely to have a reduced impact on the malaria situation as a whole if a large proportion persist in using the unregulated private sector. For this reason, inclusion of the private sector is a key component of improving malaria service provision on a national scale.

Local or regional elimination of malaria will rely, in part, on access to treatment and accurate reporting of case numbers. If this ideal is to become a reality the inclusion of the private sector in these
efforts can be seen as vital. In areas where vivax and falciparum coexist (such as all of South Asia), diagnosis and appropriate treatment of disease will be of paramount importance; treatments for the two species differ and accurate diagnosis is central to applying appropriate treatments. Access to accurate diagnosis is therefore as important as the delivery of drugs, and some would argue that it is a prerequisite. Practices in the private sector may propagate drug resistance in falciparum malaria – access to the correct ACT treatments is limited and unquantified at best. This means that most people who present at the private sector are treated with mono-therapies (most likely chloroquine (CQ) and/or sulfadoxine/pyrimethamine (SP)). It is known from experience in South East Asia and Africa that prolonged use of monotherapies promotes development of resistance. If this were to occur, national and regional treatment policies will require expensive revision and the impact on health could be significant. The current official first-line treatment for uncomplicated falciparum malaria, the combination of artesunate (AS) and SP, is effective and will inhibit drug resistance development. As well as its high clinical efficacy, its effect on gametocytes (the form of malaria parasite which infects mosquitoes) is well documented and it is likely have an effect on transmission, since (in contrast to monotherapies) it eliminates gametocytes from the blood very effectively.

The private sector may also be vulnerable to the supply of counterfeit or substandard drugs. In many parts of the world where malaria is a major health problem, counterfeit or substandard drugs are increasingly recognised as a major threat; in Cambodia ~70% of drugs available in the private sector did not conform to international standards, and lower, though worrying rates have also been detected in Africa. There is good evidence from Pakistan in 2004 that an outbreak of falciparum malaria affecting some 500 people was contributed to by substandard fansidar (although this was supplied by the public sector). The private sector practitioner may be unaware that he or she has purchased counterfeit drugs. These, of course, will be associated with poor treatment outcomes. Substandard drugs are often locally manufactured generics with poor manufacturing practice. Since they may contain some active ingredient below the recommended therapeutic dose, they may propagate resistance development. Poor treatment outcomes caused by counterfeit or substandard drugs may undermine public confidence in the most effective treatments available. Since the private sector remains unregulated and there is no quality assured supply of drugs, engagement with this sector is vital to ensuring assured supplies of drugs.

Therefore an unregulated and unengaged private sector, although a provider of services to many, presents a number of significant threats to malaria control. Acknowledging these threats, and the potential benefits of engaging with the private sector to ensure quality provides the
backdrop for this study which was undertaken to assess the current role of the private sector in malaria control in Afghanistan. This was with the goal of gathering an understanding of current practices, user rates and cost in order to assist in development of a policy aimed at engaging with the private sector to improve quality service provision. Ethical approval was granted from the Institutional Review Board, Ministry of Public Health.

1.1. Goal:

- To establish the current role of private sector in malaria control in Afghanistan and investigate where and how the private sector can be involved in malaria control in Afghanistan.

1.2. Aims:

- To investigate private sector usage for fever treatment
- Quantify the quality and range of services available in the private sector
- Investigate knowledge of treatment protocols in the private sector
- Assess costs of service provision.
- Investigate the feasibility of a private sector certification and accreditation scheme for malaria diagnostic and treatment services.

Methods:

Study areas:

The study was conducted in three provinces in Afghanistan: Baghlan, Laghman and Takhar. These provinces were purposefully chosen from strata 1 provinces – areas identified as high risk for malaria transmission, of which there are fourteen. They are characterised by urban centres (Pul-i-Kumri, Mehterlam, and Taloquan, respectively) as well as having rural areas. Most areas within these provinces are endemic for malaria. They can be seen as representative of the most malaria endemic areas of Afghanistan.

Study Components:

To meet the aims of the study, three components were conducted:

Household Survey: The household survey was conducted to identify determinants of fever in households, estimate the proportion of households who use the private sector and to estimate costs of fever episodes.

Facilities Survey: The facilities survey was conducted to identify current practices at private sector facilities. Information was collected on education, length of service, quality and range of services, willingness to participate in malaria control initiatives and quality improvement schemes. Cost of services were also assessed.
Exit Surveys: At facilities providing consultations identified by the facilities survey, exit interviews were conducted to assess user perceptions, cost, and reasons for visiting each facility.

**Household Survey Methods:**

**Selection of Households:**

Thirty clusters (villages) were selected randomly from each province (AIMS). In each cluster 20 HH were included. Households were selected by random transect sampling from a central point in the village. Every second to fifth household (dependent on the size of the village) on the transect was enrolled and additional transects added until the required sample size was reached. This gave a total target sample size of 600 HH per province.

**Questionnaire:**

In each household, the head of household or spouse responded to a structured questionnaire, often in conference with other family members. The questionnaire consisted of three sections. The first collected household information including number of individuals in the household, ages, gender and socio-economic status. Section two examined ITN ownership (part of a separate survey), and section three examined fever in the household. The number of fever cases in the last 6 months, and detailed information on up to three such cases was collected. This information asked about healthcare usage, preference, perception and cost. Respondents gave informed consent to participate. The questionnaire is attached as annex 1.

**Data management and analysis:**

Data was recorded by trained field surveyors onto the questionnaire form. Data forms were labelled with the HH number, village number, district and province. Data forms were returned to the field office and collated. Data was then double entered and cross checked using Epi-Info 2000 (CDC, Atlanta, GA, USA).

Analysis was conducted to investigate the outcomes of febrile illness in the household, primary source of healthcare provision and cost using STATA version 8. Explanatory variables were identified on an *a priori* basis and explored using appropriate tests for significance. Univariate analysis was conducted, and where appropriate multivariate analysis using logistic regression analysis. Explanatory variables used are detailed in the results section.

**Facilities Survey Methods:**

**Selection of facilities;**

Prior to the survey, all private sector health facilities in the provinces were mapped by field teams. A list of private sector facilities was created. Private sector was defined as: operating on a commercial basis and providing healthcare services on a
for-profit bases with no formal link to the public sector (BHPS or EPHS). Facilities were classified into three categories; clinic (defined as conducting medical consultations as the primary function whether or not the practitioner was a qualified doctor), pharmacy (defined as selling medical drugs to the general public as the primary function and not giving consultations) and laboratory (defined as providing diagnosis as the primary function and not giving consultations). Within each category, individual numbers were assigned to each facility. A random number generator was used (MS Excel 2007) to generate 30 numbers each for pharmacies and laboratories and 60 numbers for clinics between the total number of facilities in the province in each category. In this way, 60 health practitioners, and 30 each of pharmacies and laboratories were randomly selected in each province. In total, 180 practitioners, 90 pharmacies and 90 laboratories were selected for inclusion. A reserve list of facilities was also given to survey teams, so that if a facility could not take part for whatever reason, the next on the list was selected as an alternate.

**Questionnaire:**

In each facility the person primarily responsible for consultations, dispensing or conducting laboratory functions was questioned by trained field surveyors. The questionnaires were field tested and followed the same structure for each facility collecting information on: level of education and professional affiliations; service provision; service costs and willingness to participate in malaria control interventions. Individual questions were tailored to each facility type. Questionnaires are attached as annex 2, 3, and 4.

**Data Management and Analysis:**

Data was noted on questionnaire forms (annex 2, 3, and 4) by trained field surveyors. Forms were marked with facility number, district and province. Forms were returned to field offices and double entered using Epi-info 2000 (CDC, Altanta, GA, USA).

Data was analysed using STATA version 8. Primarily, simple proportions were used to provide a picture of generally applicable characteristics of the private sector. Differences between provinces and other explanatory variables, if any, were noted using appropriate tests of significance. Cost data was analysed using Afghani (AFG) as the currency (at the time of writing 1 USD was worth 50 AFG).

**Exit Survey Methods:**

**Selection of participants:**

The facilities conducting consultations that were selected for the practitioners survey acted as the recruitment points for the exit survey. A convenience sample provided five persons exiting the selected facilities for enrolment in the study. They were explained the
purposes of the survey and gave informed consent to take part in the study. They were identified as patients, or relatives/friends of patients. If the patient was a minor the accompanying adult participated.

**Questionnaire and data analysis:**

A structured questionnaire was administered by trained surveyors. It collected patient details (age, sex), reason for attendance at the facility, perceptions of service quality, and cost. The questionnaire is attached as annex 4. Data was evaluated as in the other surveys using double entered data analysed using STATA 8. Primarily, simple proportions are presented, with differences investigated using appropriate tests for significance.

**Results:**

**Household survey:**

**Sample Characteristics:**

A total of 1,776 households were enrolled in the household survey in November 2007, amongst 84 villages in the three study provinces. Approximately 600 households were enrolled per province, and an average of 20 households per village (table 1). Twenty four records were not included in the analysis due to poor quality data recording.

<table>
<thead>
<tr>
<th>Sample Characteristics</th>
<th>1,776</th>
<th>84</th>
<th>580-600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number (N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Villages (clusters)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number households per province (range):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number person per household. (Mean [SD])</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1: Sample Characteristics.**

There were an average of 8.7 (SD: 4.5) persons per household in the sample, marginally above the standard of 7.5 persons per HH used in Afghanistan. The proportion of households with at least one child under 5 years was 85.2%. Table 2 details household characteristics. There were some differences seen between provinces indicated in the table.

<table>
<thead>
<tr>
<th>Household Characteristics</th>
<th>Laghman</th>
<th>Takhar</th>
<th>Baghlan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number person per household (Mean [SD])</td>
<td>9.8 (4.9)</td>
<td>7.2 (3.6)</td>
<td>9.3 (4.4)</td>
</tr>
</tbody>
</table>
Table 2: Household characteristics for the sample, by province.

Socioeconomic status was derived using principle components analysis. The model included household assets, education level of head of household and income source of the HH primary wage earner. This model was used to define socioeconomic quintiles which are detailed in table 3.

Table 3: Socio-economic characteristics of the sample, defined using principle components analysis.

Analysis of fever in the Household: In total, 1,126 (67.7%) of households reported at least one case of fever in the household in the previous 6 months. The
median number of fevers was 1 per household (range 0-9). Factors associated with fever in the household were examined.

Table 4 shows determinants of fever in the household, using household level exposure factors.

<table>
<thead>
<tr>
<th>Exposure variable</th>
<th>n/N (%) in Exposed</th>
<th>OR (95%CI)</th>
<th>AOR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEQ*</td>
<td>319/424 (75.2)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1 (poorest)</td>
<td>177/248 (71.4)</td>
<td>0.8 (0.6-1.2)</td>
<td>0.9 (0.6-1.3)</td>
</tr>
<tr>
<td>2</td>
<td>238/324 (73.5)</td>
<td>0.9 (0.7-1.3)</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>3</td>
<td>205/338 (60.7)</td>
<td>0.5 (0.4-0.7)</td>
<td>0.7 (0.5-1.0)</td>
</tr>
<tr>
<td>4</td>
<td>187/330 (56.7)</td>
<td>0.4 (0.3-0.6)</td>
<td>0.6 (0.4-0.9)</td>
</tr>
<tr>
<td>5 (least poor)</td>
<td>348/552 (63.0)</td>
<td>0.7 (0.6-0.9)</td>
<td>1.1 (0.8-1.5)</td>
</tr>
<tr>
<td>Presence of infant aged 0-1 NS</td>
<td>591/872 (67.8)</td>
<td>1.0 (0.8-1.2)</td>
<td>-</td>
</tr>
<tr>
<td>Presence of child aged 1-5 NS</td>
<td>914/1386 (66.9)</td>
<td>0.8 (0.6-1.1)</td>
<td>-</td>
</tr>
<tr>
<td>Pregnant woman in the HH NS</td>
<td>277/394 (70.3)</td>
<td>1.1 (0.9-1.5)</td>
<td>-</td>
</tr>
<tr>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laghman</td>
<td>371/593 (62.6)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Takhar</td>
<td>526/563 (93.4)</td>
<td>8.5 (5.9-12.3)</td>
<td>7.1 (4.6-10.9)</td>
</tr>
<tr>
<td>Baghlan</td>
<td>276/579 (47.9)</td>
<td>0.6 (0.4-0.7)</td>
<td>0.4 (0.3-0.6)</td>
</tr>
<tr>
<td>Keeping animals at home*</td>
<td>974/1381 (70.5)</td>
<td>1.8 (1.4-2.3)</td>
<td>1.4 (1.1-1.9)</td>
</tr>
<tr>
<td>ITN in the home NS</td>
<td>350/538 (65.1)</td>
<td>0.8 (0.7-1.0)</td>
<td>-</td>
</tr>
<tr>
<td>Use of ITN at present time***</td>
<td>241/383 (62.9)</td>
<td>0.8 (0.6-1.0)</td>
<td>0.6 (0.5-0.8)</td>
</tr>
<tr>
<td>Use of ITN by children &lt;5yrs NS</td>
<td>150/236 (63.6)</td>
<td>0.8 (0.6-1.1)</td>
<td>-</td>
</tr>
<tr>
<td>Water Source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well</td>
<td>377/551 (68.4)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pond</td>
<td>17/20 (85.0)</td>
<td>5.1 (1.4-17.7)</td>
<td>2.2 (0.6-8.8)</td>
</tr>
<tr>
<td>River</td>
<td>141/267 (52.8)</td>
<td>1.9 (1.4-2.6)</td>
<td>1.5 (1.0-2.1)</td>
</tr>
<tr>
<td>Spring</td>
<td>235/288 (81.6)</td>
<td>4.0 (2.7-5.8)</td>
<td>1.5 (0.9-2.3)</td>
</tr>
<tr>
<td>Pump</td>
<td>375/567 (66.1)</td>
<td>1.7 (1.3-2.3)</td>
<td>1.4 (1.0-2.0)</td>
</tr>
<tr>
<td>Tap/City</td>
<td>28/39 (71.8)</td>
<td>2.3 (1.1-4.8)</td>
<td>0.6 (0.2-1.5)</td>
</tr>
</tbody>
</table>

Table 4: Determinants of fever in the household. OR=unadjusted odds ratio; AOR=Adjusted odds ratio; 95%CI=95% Confidence Intervals.

Socio-economic status was associated with fever in the household with those in the lowest SEQ being more likely to report at least one fever episode. This association was seen on univariate and multivariate analysis. Other factors associated with fever in the household were province, keeping animals in the compound, use of ITNs and water source. Keeping animals in the household was positively associated with fever at the household level, and may also be related to malaria incidence. Use of ITN at the present time (i.e. last night in the household) acts as an
indicator of regular use. Its negative association with fever at the household level suggests that it is protective against malaria, and that malaria is an appreciable cause of febrile illness. Amongst the sub-sample of fever patients, 483/1,163 (41.5%) was reported as malaria, although this should be interpreted with caution, since no proof of diagnosis is available. Water source was associated with fever at the household level, with those using unsafe water sources (pond and river) being more likely to report fever. This may indicate an interaction with malaria and its vectors, with users being close to breeding sites, but is also likely to be influenced by the quality of the water supply. Interestingly usage of street hand-pumps was also associated with fever.

**Treatment seeking:**

Detailed data was collected from up to three fever cases detected during the HH survey. Here, detailed analysis is conducted on the first fever case for which data was collected. Differences, if any, between the reported cases (first, second or third) are also assessed.

In total, detailed data was collected for 1600 fever cases (1,147 (71.7%) as the first reported fever case, 337 (21.1%) as the second, and 116 (7.3%) as the third). Among the first reported fever case, 1,021/1,095 (93.2%) sought treatment. There was heterogeneity in those who sought treatment, by SEQ, but there is no clear trend (Table 5). Sex of the patient was associated with treatment seeking on univariate analysis, although this association disappeared, suggesting confounding with other factors. Treatment seeking for fever also differed between provinces, perhaps signalling differing access to healthcare or home treatment practices. In patients under 5 years, treatment was more likely to be sought (by caregivers).

<table>
<thead>
<tr>
<th>Exposure Variable</th>
<th>n/N (%) in Exposed</th>
<th>OR (95%CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEQ**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (poorest)</td>
<td>294/312 (94.2)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>154/167 (92.2)</td>
<td>0.7 (0.3-1.5)</td>
<td>0.7 (0.3-1.6)</td>
</tr>
<tr>
<td>3</td>
<td>205/231 (88.7)</td>
<td>0.5 (0.3-0.9)</td>
<td>0.4 (0.2-0.9)</td>
</tr>
<tr>
<td>4</td>
<td>191/203 (94.1)</td>
<td>1.0 (0.5-2.1)</td>
<td>0.9 (0.4-2.0)</td>
</tr>
<tr>
<td>5 (least poor)</td>
<td>177/182 (97.3)</td>
<td>2.2 (0.8-5.9)</td>
<td>2.1 (0.8-6.1)</td>
</tr>
<tr>
<td>Sex of Patient***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>448/471 (95.1)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>610/666 (91.6)</td>
<td>0.6 (0.3-0.9)</td>
<td>0.7 (0.4-1.2)</td>
</tr>
<tr>
<td>Province*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laghman</td>
<td>362/370 (97.8)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Takhar</td>
<td>491/515 (95.3)</td>
<td>0.4 (0.2-1.0)</td>
<td>0.6 (0.4-1.2)</td>
</tr>
<tr>
<td>Baghlan</td>
<td>205/252 (81.4)</td>
<td>0.1 (0.04-0.2)</td>
<td>0.1 (0.05-0.3)</td>
</tr>
</tbody>
</table>
Table 5: Determinants of treatment seeking amongst fever cases. OR=unadjusted odds ratio; AOR=Adjusted odds ratio; 95%CI=95% Confidence Intervals.

Of those who sought treatment, 491/1,093 (44.9%) did so in the private sector. Of these, most went to private clinics (77.8%) with 11.8% going to pharmacies. The remainder went to general stores (7.7%) and traditional healers (2.0%). Few went to other sources (0.6%).

Factors associated with private sector use were also examined. Although overall use of the private sector was high in all SEQs, it was more frequent in the least poor than the poorest (54.5% vs. 43.3%, **Chi$^2$: 5.5, p=0.02). Use of the private sector was homogeneous between provinces, suggesting that use is frequent in most areas. Neither sex of the patient nor age group was associated with differing use of public or private sectors.

Cost Analysis:

For all those who sought treatment, cost data was also collected. Costs incurred for direct and indirect costs were evaluated – costs of consultation, drugs, lab or x-ray, travel and food costs. Table 6 shows median costs for each category and in total. Costs are displayed in Afghani (AFG). At the time of writing, 50 AFG was worth 1 USD. There was a substantial difference between cost in the public and private sector, with the private sector being some 3 times the cost of the public sector. The main contributor to this difference is the cost of drugs. The cost of consultation, although >10x higher in the private sector, was a minor contributor compared to drug costs to the total. Cost of lab and indirect costs contribute relatively little to the cost differential.
Table 6: Cost comparison between public and private sector amongst those who sought treatment for fever.

Also of interest is variation in the cost of fever in the private sector, between groups of users. There was no difference between total cost when examined by sex, age of patient or SEQ. Costs did differ between province, with care in Laghman being most expensive (Median 490 AFG [IQR: 320-795]) and that in Takhar being least expensive (Median, 354 AFG [IQR: 150-590] – sign-rank test, p<0.001).

More than 50% of those who sought treatment for fever had problems with paying for the services they received. Of those who sought treatment in both public and private sector, 489/1,105 (48.2%) reported that they had no problem paying. Of those who had problems paying, 23.6% borrowed money, 12.1% sold something, and 13.4% paid with serious consequences. This differed between the public and private sector, with 45.2% vs. 60.0% reporting problems with payment, respectively (Chi$^2$: 22.1, p<0.001). As expected, large differences were seen between SEQ with 62.6% reporting problems with payment in the poorest, vs. 29.7% in the least poor.

**Attitudes, Services and Perceptions:**

The two principle reasons for use of the private sector were quality of service (30.9%) and closeness (24.0%). Secondary reasons given were availability of drugs (12.5%) and time taken for consultation (19.4%). Perceptions of this type did not differ between SEQ.

Most people (86.3%) presenting at the private sector did so for consultations, in line with the high proportion who attend clinics over other facilities. Overall, in both public and private sectors, 75.7% of fever patients who presented for treatment had a malaria blood smear taken. This differed by sector, with 81.5% of those in the private sector vs. 71.0% in the public sector (Chi$^2$: 15.5, p<0.001) having a laboratory diagnosis. Taking of blood smears also differed by province. More people in the public sector received health education messages (55.9% vs. 41.1%, Chi$^2$: 21.1, p<0.001).

Overall levels of satisfaction were high, with >75% who use either sector reporting that they were satisfied with the services received at the facility. This proportion differed by sector, with 71.9% in the public sector vs. 82.9% of the private sector reporting satisfaction. More people reported being some-what satisfied by services in the public sector than the private sector. Patients reporting less-than-expected levels of respect from healthcare workers were higher in the public sector (Chi$^2$: 44.0, p<0.001). Interestingly, people using the private sector registered dissatisfaction at the waiting times much more frequently.
(48.4% vs. 19.9%). This is likely due to differing perceptions of acceptable waiting times, and is not likely to reflect actual waiting time; those who expect a quick service, for which they pay, will be less inclined to accept waiting times than those who expect to have to wait (such as in the public sector).

**Facilities Survey:**

**Sample Characteristics:**

In total, 353 facilities were surveyed in August 2008. Of these, 173 were health practitioners clinics, 85 were laboratories and 95 were pharmacies. These were approximately equally distributed across provinces (Table 7).

<table>
<thead>
<tr>
<th>Province</th>
<th>Facility Type</th>
<th>Province</th>
<th>Facility Type</th>
<th>Province</th>
<th>Facility Type</th>
<th>Province</th>
<th>Facility Type</th>
<th>Province</th>
<th>Facility Type</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Health Practitioner</td>
<td></td>
<td>Laboratory</td>
<td>Pharmacy</td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baghlan</td>
<td>58</td>
<td>28</td>
<td>29</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laghman</td>
<td>52</td>
<td>29</td>
<td>37</td>
<td>118</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takhar</td>
<td>63</td>
<td>28</td>
<td>29</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>173</td>
<td>85</td>
<td>95</td>
<td>353</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Number of facilities included in the survey of private sector facilities in three provinces.

For each facility type, questionnaires differed. For this reason the results of each facility type are detailed in separate sections, below.

**Health Practitioners Clinics:**

One hundred and seventy three facilities were included in the survey. In conforming to the definition of health practitioner used in the selection, they were categorised into four groups; 84 (48.8%) were MDs, 62 (36.1%) were nurses, 16 (9.3%) were health-workers and 10 (5.8%) were classified as other, including pharmacists (n=6) and lab technicians (n=2). Only one “traditional healer” was included in the sample. Characteristics of the sample as a whole are shown in table 8, below. The majority (53.8%) had attended medical college, with 12.3% having attended 1-2 year medical courses. In approximately equal proportions, respondents had learned their skills in college or on the job, and the majority were registered with the MoPH (locally). Out of all practitioners surveyed, 57.6% also worked in the pubic sector and two thirds of MDs worked in the public sector.

Details of services provided showed that most facilities reported that they treat malaria. The median number of cases seen in the last month was 8 cases (IQR: 2-20) per facility. In total, 7 deaths were reported from all facilities. Diagnosis was most commonly by blood slide (78.6%) with 26.6%
reporting use of clinical diagnosis. Almost all reported giving health education messages to patients.

| % of facilities treating malaria patients | 156 (90.1) |
| Number malaria patients per facility in last month [median (IQR)]: | 8 (2-20) |
| Number malaria deaths (total in all facilities): | 7 |
| How do patients get diagnosed in this clinic | |
| Blood slide | 136 (78.6) |
| RDT | 4 (2.3) |
| Clinical | 46 (26.6) |
| Lab and clinical | 36 (20.8) |
| % with RDT at the facility: | 14 (8.2) |
| % who would trust the RDT result: | 30 (18.4) |
| % who think RDT would be useful | 67 (41.6) |
| Provision of health education messages on malaria prevention: | 169 (99.4) |
| ITNs | 165 (95.3) |
| Symptoms recognition | 15 (8.7) |
| Treatment | 12 (6.9) |

Table 8: Services provided at private sector practitioners facilities.

Referral for diagnosis of patients did not differ between child and adult patients – almost all refer either all febrile patients, or when they suspect malaria. When asked about the national treatment guidelines, vivax malaria was well known to be treated with chloroquine (>90%), an old regimen that has been used for decades. However, for Pf malaria, very few (1.8%) were able to correctly name AS/SP as the first line treatment. Many (29.4%) thought SP monotherapy was first line treatment for Pf, and 3.6% with chloroquine and SP. Chloroquine monotherapy was reported by 17.2% as first line treatment for uncomplicated falciparum malaria and quinine was reported by 23.3%. Two (1.2%) reported artesunate monotherapy. When asked if they prescribe “combination therapy”, 51.2% responded positively, suggesting widespread misconception in the understanding of the phrase, since most referred to combinations of antimalarials and antipyretics. Few reported prescribing primaquine although 26% reported referral for G6PD testing.

In keeping with these results, of the 142 (83%) who stocked drugs in the facility, 82.1% had chloroquine, 71.7% had fansidar and 50.3% had quinine. Other drugs reported were mefloquine (1.7%), amodiaquine (5.8%), artesunate (9.8%), primaquine (2.3%) and halofantrine (5.2%).
More than 90% of facilities that stocked drugs got them either from the local bazaar or from wholesalers.

Cost of drugs reported by practitioners was much lower than those reported in the household survey at 10 AFG (vs. 100 AFG), as was cost of consultation (50 AFG vs. 100 AFG). Half of respondents reported that they adapt the price of the consultation according to the patient's economic status, while a quarter report that they let the patient decide or contribute. The remainder have a fixed price.

Most facilities reported that they would be willing to participate in malaria control efforts, including education and training, regulation, allowing monitoring of their facilities and case recording and reporting. Most (>90%) would be willing to supply ITN through their facilities, presumably because of the commercial implications. Fewer would participate in health education and awareness programs, although ~50% would.

**Laboratory Survey:**

Eighty five laboratories were included in the study, equally distributed between provinces (Table 7). Most had learned their trade on-the-job and 50% had never had any formal training. Median length of practice was 7 years (IQR: 4-15.5). Facilities were small, with >70% having only one lab technician. Working in the public sector in addition to the private sector was common (60%).

In keeping with the level of malaria endemicity in the study areas, almost all provided malaria diagnosis (98%). Other diagnostics available in about half of facilities were TB, Widal, hepatitis, HIV, stool, urinalysis and blood count. Of those who provided malaria diagnosis all did so by microscopy having a median of 40 slides per week (IQR: 0-500), with estimated slide positivity rate of 10%. Slides were checked for a median of 5 minutes, and approx 88% check 100 fields before declaring the slide negative. Reportedly, lancets are not reused by 60% of laboratories, although 29% report that they let blood on the lancet dry before reusing. This requires urgent confirmation and, if necessary, remedy, since blood borne infection is a serious risk.

Some clinics (8.2%) reported availability of RDT, some of which were species specific (i.e. can differentiate between vivax and falciparum malaria). Most (70%) would neither believe the result nor find RDTs useful.

The average cost of diagnosis was 31.6 AFG (standard deviation: 10.9). As a comparator, programme costs per slide have been estimated (excluding capital costs) at USD 0.11 (5.5 AFG). Most (64%) report that they adapt the price according to the economic status of the client.
Willingness to participate in malaria control efforts was high. Most would participate in training, and most agreed to regulation through training and providing guidelines, as well as monitoring for quality. Again, most were willing to supply ITNs, but few other control tools (coils and sprays or insecticide). Some would participate in health education and awareness by having leaflets or displaying posters.

*Pharmacies Survey:*

 Ninety-five facilities were included in the survey, equally distributed across provinces (Table 7). There was a range of educational levels, but most had learned their skills on the job or through apprenticeships. Median length of practice was 7 years (IQR 4-15). Customers come to pharmacies either directly, or on referral from a doctor.

A high proportion reported that they give antimalarial drugs on the prescription of a doctor (74%), or with lab results (28%). A smaller proportion would give antimalarials “if a customer asks for them” (8.4%). This finding may reflect the high proportion of patients who seek treatment for fever (>90%) and thus have either a diagnosis or a prescription, rather than the pharmacists refusing to sell. For undiagnosed fever presenting at the pharmacy, 6% say that they would give an antimalarial, with most saying that they refer the patient to a clinic (50%), and 45% giving an antipyretic/painkiller. A high proportion state that they do not give drugs to a relative or friend of a patient who has fever, but refer to a doctor (86%).

In concordance with the findings of the practitioners survey, almost all pharmacies (99%) stock chloroquine and 17% stock IM chloroquine. The majority stock SP (83%). Oral quinine is stocked by 40% and IV quinine by 9.5%. None provided ACT per se, although artesunate was reported in 5.3% of clinics. Other drugs were stocked in minor proportion; mefloquine (1.1%), amodiaquine (11.6%), primaquine (8.4%), halofantrine (9.5%), and artemether IM (1.1%). Drugs are supplied to the pharmacies either from the local bazaar (40%) or from wholesalers (44%). Some get their drugs from salesmen/reps (26%) while the remainder (11%) import the drugs themselves. Table 9 shows median prices of the drugs in stock per adult dose:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Price (AFG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CQ</td>
<td>10 (5-80)</td>
</tr>
<tr>
<td>SP</td>
<td>15 (2.4-50)</td>
</tr>
<tr>
<td>Quinine</td>
<td>53.5 (3-150)</td>
</tr>
<tr>
<td>Mefloquine</td>
<td>12 (9.6-120) [n=3]</td>
</tr>
<tr>
<td>Amodiaquine</td>
<td>22 (9-36) [n=5]</td>
</tr>
<tr>
<td>Primaquine</td>
<td>12.5 (5-60) [n=8]</td>
</tr>
<tr>
<td>Artesunate</td>
<td>12 [n=1]</td>
</tr>
<tr>
<td>Halofantrine</td>
<td>20 [n=1]</td>
</tr>
</tbody>
</table>
Few (22%) had attended any training in the last 12 months, and most training was provided by MoPH. In keeping with the lack of training, knowledge of national guidelines was low. As in the practitioners survey, knowledge of the 1st line for vivax malaria was high – reflecting the long-term use of chloroquine. However, knowledge of falciparum guidelines was low, with none identifying ACT as the 1st line treatment. Few (30%) had copies of the national guidelines.

Willingness to participate in malaria control initiatives was high. Almost all would participate in training, while the majority would agree to regulation through training and providing guidelines. Many would also agree to monitoring by MoPH for quality and data collection. As in the other facilities, pharmacies would stock and provide ITNs (96%), probably because of the commercial aspects of this activity. About 50% would provide leaflets, display posters in their pharmacies and help organize community campaigns.

**Exit Survey:**

Five hundred and fourteen exit interviews were conducted, with 5-7 interviews conducted at each health practitioner facility. Enrolment characteristics are shown in Table 10.

<table>
<thead>
<tr>
<th>Total</th>
<th>514</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number per province</td>
<td></td>
</tr>
<tr>
<td>Baghlan</td>
<td>148 (28.8%)</td>
</tr>
<tr>
<td>Laghman</td>
<td>211 (41.1%)</td>
</tr>
<tr>
<td>Takhar</td>
<td>155 (30.2%)</td>
</tr>
<tr>
<td>Sex of Patient (% Male, Female)</td>
<td>254 (49.5)</td>
</tr>
<tr>
<td>Age of Patient (Mean)</td>
<td>26.4 (SD 17.6)</td>
</tr>
<tr>
<td>Age group (% in each)</td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>92 (17.9%)</td>
</tr>
<tr>
<td>6-10</td>
<td>14 (2.7%)</td>
</tr>
<tr>
<td>11-20</td>
<td>109 (21.2%)</td>
</tr>
<tr>
<td>21-40</td>
<td>209 (40.7%)</td>
</tr>
<tr>
<td>&gt;40</td>
<td>90 (17.5%)</td>
</tr>
<tr>
<td>Is the Patient same as the interviewee (%Yes)</td>
<td>347 (68.7%)</td>
</tr>
<tr>
<td>Relation of interviewer with patient</td>
<td></td>
</tr>
</tbody>
</table>
Child 3 (1.9%)
Parent 99 (61.5%)
Grand parent 11 (6.8%)
Uncle/ Aunt 4 (2.5%)
Brother/Sister 28 (7.4%)
Friend 1 (0.5%)
Other 15 (9.3%)

What was the problem that made you go to the health facilities
Fever 231 (44.9%)
Headache 180 (35.0%)
Vomiting 79 (15.4%)
Body pain 146 (28.4%)
Chills 47 (9.1%)
Cough 56 (10.9%)
Diarrhea 85 (16.5%)
Flu/Cold 22 (4.2%)
Stomach Pain 92 (17.9%)
Other 77 (14.9%)

Table 10: Enrolment characteristics of exit interviews at private sector clinics.

The principle reasons for use of the facility is for perceived better quality (61%) with secondary reasons being proximity (29%) and quality of staff (19%), which was mirrored by peoples preference for the private sector in general. Most people were seen by a doctor (although this may be their impression of who is a doctor, rather than based on actual qualifications). Eight-nine percent reported that the quality of the consultation was very good or good.

Most commonly reported symptoms at presentation were fever (45%), headache (35%), body-ache (28%), with smaller proportions presenting with gastrointestinal symptoms (vomiting [15%], diarrhoea [17%], and stomach pain [18%]). Proportion presenting with fever did not differ significantly between patients aged under and over 5 years of age (53.3% vs. 43.1%; \( \chi^2 \): 3.1, p=0.07). The proportion presenting with diarrhoeal disease did differ, with 56% of diarrhoea patients being under 5 years.

Most attendees were prescribed drugs (98.4%), of which 53% were painkillers, 39.1% were antibiotics and 12% were antimalarials. It is not clear if the malaria prescriptions were given based on laboratory diagnosis. Of those with fever, 22% were prescribed antimalarials. Antibiotics were given to patients regardless of fever (40% given to those without fever vs. 38% given to those with). Those aged under 5 were more likely to be given an antibiotic but not more likely to be given an antimalarial.

Twenty-six percent of all patients were referred to a laboratory for diagnosis. Of those with fever, 32.5% were referred to a laboratory although this was higher than for people who did not have fever (20%);
chi²:10.8, p=0.001). The number who had had a diagnosis prior to presentation at the facility was not recorded, although most people in the household survey reported the clinic as their first point of contact. This provides circumstantial evidence that reported practices may differ from actual practices.

The median total cost for the episode of illness was 530 AFG (IQR: 270-1130), including direct, indirect and opportunity costs. The median direct cost of the episode of illness was 260 AFG (IQR: 160-400 AFG). Included in this sum were consultation cost, prescription cost, lab or x-ray cost, ultrasound, ambulance. Indirect costs were less, with the median of 12 AFG (IQR: 0-130). Indirect costs included transport, food and accommodation costs. Opportunity costs were also estimated by asking the loss of earnings of either the patient or accompanying person or both. Median opportunity cost was 108 AFG (IQR 0-360). There was significant heterogeneity between provinces for each cost category. Cost for children under 5 years did not differ from those over 5 years.

Amongst those who purchased services, median price is shown in table 11.

<table>
<thead>
<tr>
<th>Service</th>
<th>Median Price</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription</td>
<td>180 AFG</td>
<td>12-6290 AFG</td>
</tr>
<tr>
<td>Consultation</td>
<td>80 AFG</td>
<td>20-800 AFG</td>
</tr>
<tr>
<td>Lab</td>
<td>40 AFG</td>
<td>12-450 AFG</td>
</tr>
<tr>
<td>X-rays</td>
<td>150 AFG</td>
<td>84-300 AFG</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>150 AFG</td>
<td>150-2000 AFG</td>
</tr>
<tr>
<td>Ambulance</td>
<td>100 AFG</td>
<td>20-1000 AFG</td>
</tr>
</tbody>
</table>

Table 11: Price of services.

Conclusions and Discussion:

This collection of studies represents the first systematic assessment of the private sector in malaria control in Afghanistan. The study examined the role of the private sector from three angles in malaria endemic areas; firstly at the household level, secondly at the facility level and thirdly at the user level. It provides a number of important findings which are of use in development of policies to include the private sector in effort to improve diagnosis, treatment and control of the disease.

Socio-economic status and a number of other household level factors are linked to risk of fever. Those in the poorest groups are more likely to report fever in the household. ITN use appears, by this methodology, to be protective against fever in the household, further evidence that this intervention is worthwhile and providing ecological evidence that malaria is a significant contributor to febrile illness.

Most people seek treatment for fever, but there are separate determinants of treatment seeking. Treatment seeking differs by province, suggesting either
inequities in access to healthcare and/or differing home-treatment practices. It is perhaps unsurprising that age group of the patient is related to treatment seeking. Of those who do seek treatment around half do so in the private sector, most often in private sector clinics. By this analysis, there are no clear determinants of private sector use and it can be concluded that this is a major source of healthcare provision in all sectors of communities. This finding confirms those of other studies in Afghanistan.

With this high proportion of the population using the private sector, efforts to improve services and regulate practice are important. If malaria specific interventions are implemented solely through the public sector, their effectiveness will be limited because a large proportion of patients use the private sector.

Cost of services is around three times higher in the private sector than the public sector. Out of pocket expenditure on healthcare is likely to cause economic hardship in the impoverished; costs are uniform across socio-economic strata, while ability to pay varies widely. Payment for consultations and diagnostics is reported by practitioners to be flexible according to socioeconomic status. The evidence, however, suggests that cost is similar when examined by socioeconomic status making this gesture ineffective. The effect of payment of these costs is severe, especially on the poor. The major cost in private sector healthcare is the cost of drugs.

A perception of greater quality in the private sector is the main driver of its use. This may be related to factors less tangible than quality of the practitioner, but more to do with the experience of public sector users and user expectations.

The private sector is providing the correct treatments to those with vivax malaria. Of note, however, is the lack of knowledge of the treatments for falciparum malaria amongst practitioners and pharmacists. Practitioners frequently work in the public sector as well as the private sector suggesting that knowledge of the national guidelines is limited at best, regardless of sector.

Provision of G6PD testing is limited and consummately, so is the use of primaquine. Use of anti-relapse therapy is likely to be pivotal in efforts to eliminate malaria.

The private sector is heavily dominated by chloroquine, fansidar and quinine. Other drugs are also available in lesser proportions. One facility reported stocking artesunate but far below generally accepted market prices. If this is truly artesunate, it is unlikely to be genuine.

Supply of drugs to the private sector appears to be primarily through secondary sources – wholesalers and purchased from other shops in the bazaar.

Diagnostic services are primarily by microscopy, with very few stocking or using RDTs. Microscopy is seldom, if ever, quality assured. Most do not see a great role for RDTs and this limited set of questions suggests that their implementation will be far from straight forward.
Training levels are low in all facilities surveyed and many pharmacists and laboratory technicians appear to have no formal training. Willingness to participate in training schemes is high in all facilities surveyed. Most state that they would agree to regulation of some form, and many would participate in disease monitoring.

Some discrepancies between reported practice (from the facilities survey) and actual practice (from the exit survey) are evident, suggesting that actual practice does not correlate well with knowledge.

Amongst these main findings there are threats and weaknesses as well as opportunities and strengths. It seems that the inclusion of the private sector in malaria control requires a pragmatic approach with the clear aim of improving the level of service within the private sector, rather than controlling it or attempting to attract people to the public sector. This data allows consideration of these opportunities and allows for setting of key indicators and targets for inclusion in programming. It is outside the scope of this report to set these indicators and targets – this is a task that requires consultation with stakeholders, including private sector representatives.

If the private sector policy is to be successful it will require resources and a sustained approach of meaningful measures. One component of engagement with the private sector will be training, but this alone is unlikely to improve the current situation. In addition to training the sector will require assistance in improving diagnostic and treatment practices, and the public will require sensitisation to change expectations. The private sector will be adept at changing practice if it is to their commercial advantage.

The study design has a number of potential limitations. Perceptions of fever and illness vary widely, and, by necessity, there is no clinic definition of fever in this study. Differing perceptions between studies (i.e. between the public at-large and practitioners) may detract from the comparability of data. Bias in reporting may be a factor, although many data points triangulate well with other components of the study (for example, the spectrum and supply of drugs; use of clinics over other sources as the first contact point). Selection bias may also decrease the applicability of this data to the private sector as a whole and this data should be seen as representative of the private sector in malaria endemic provinces. It may not, therefore, be applicable to other areas. However, the selection methods used conform to standard and accepted methods. There are a number of variables which could have been collected to improve the analytical picture in providing other robust explanatory variables. For example, assessment of urban, peri-urban and rural practices and perceptions would provide useful information for policy. Despite these limitations, the study methodology can be considered robust. Where necessary, the results are interpreted with caution and the
analysis of the data has been conservative, taking account of its potential limitations and difficulties in interpretation. It can be concluded that the results, as presented, provide a suitably precise estimation of the private sector, its role, and the public’s perceptions and use on which to base pilot policies.

With a large proportion of the population seeking care for fever in the private sector, the questionable quality and lack of training and the cost of care, it is an urgent policy imperative to enhance its level of service provision. Based on this analysis, recommendations are made. These are to be considered individually as well as collectively when devising policy. Any policy which is forthcoming should be target driven and pilot tested. It is important to realise that this survey and analysis does not provide evidence of efficacy of any forthcoming policies. For this reason, pilot testing and evaluation and assessment is required. Inclusion of the private sector should not be seen as a short term aim but as an iterative process of assessing what is effective and, importantly, what does not work. It will require, as with all changes in practice, a sustained approach and a long-term perspective.

The opportunities presented by this analysis are sufficient to suppose that if successful, a policy for inclusion of the private sector could improve treatment and control of malaria. The model of malaria control could act as a driver for improvements in other areas of healthcare, so there are also externalities to consider. Not to be ignored is the effect of improved service on non-malarial causes of fever, a further arena for study. The current discussions of how to eliminate or even eradicate malaria will require the inclusion of the private sector, and as the effects of elimination programs are seen, diagnosis and accurate treatment is of paramount importance in ensuring that the rising proportion of non-malarial febrile illness is also adequately addressed. The private sector provides great possibilities for provision of quality services and in sector wide approaches to disease control and evidence based engagement with this sector is required. Specific recommendations are given below.

**Recommendations:**

Recommendations below are categorised into programmatic sections, and suggestions for further research are also made. Since all of these will require resources, it is expected that these interventions will be subject to effectiveness assessment to ensure that they are cost-effective and therefore, worthwhile. While developing the final policies, it is important to include private sector representatives to ensure ownership and engagement.

**The public:**

The policy should not intend to change treatment seeking behaviour. This is unlikely
to be successful, since the perceptions of quality in the private sector is high. Rather the private sector should be seen as an important provider of services. The public need to have a better understanding of the services and treatment that they can expect, and at what price. The private sector will respond to changes in demands and communication with the public to shift demand is a prerequisite. Cost to the user (and the effect of the cost) requires urgent attention. Since the principle cost is the cost of drugs, the policy needs to ensure that cost is appropriate. Two potential remedies are required: Enhance effectiveness while maintaining stable prices. Reduce prices to match level of service.

**Practitioners**

Training is required at all levels of the private sector. Consolidation of existing professional associations can provide communication channels and mechanisms for regulation. Professional organisations should be included in the policy development process to ensure inclusion, ownership and importantly, applicability of the policy. Practitioners should continue to be allowed to provide services in both the public and private sector; preventing this practice will alienate health providers in all sectors and reduce service provision in the public sector (which pays the least).

**Diagnosis:**

Diagnostic practices require further investigation. This investigation should examine the clinical practices of practitioners to identify diagnostic referral practices and observance of results. Quality control of diagnostics is required, including reagents and microscopes. Quality of service is not quantified, but given the lack of formal training is not likely to be acceptably high. Differentiation of species is not an easy task, but is a requirement for provision of appropriate treatment. Further consideration of the implementation of RDTs is required, since confidence in their use and accuracy is low. A broad-brush approach without accompanying investigation and monitoring is unlikely to be cost-effective. Further investigation of G6PD testing in the private sector and modalities for expansion of delivery of anti-relapse therapy through this sector is required.

**Treatment:**

Treatment of vivax malaria (assuming accurate diagnosis) does not require attention. Of urgent requirement is the treatment of falciparum malaria. Formulation of national treatment guidelines specifically for the private sector is required. With the lack of quality assured microscopy, it is recommended that confirmed cases are treated with chloroquine/SP as first line treatment,
regardless of species differentiation until such time as ACT becomes readily available. Training and quality assurance is required as a prerequisite to improving access to artesunate combination therapy. A broad-brush approach to use of this combination will not be cost-effective since, in the current environment revealed by this study, it is unlikely to be used only for confirmed falciparum malaria.

In supplying ACT through the private sector, certain pre-conditions need to be ensured for individual facilities to stock and sell it. These include:

- Presence of quality assured diagnostics (either microscopy, RDT or both).
- Specific training in use of ACT
- Willingness to participate in monitoring and quality control initiatives.

ACT supply will require central coordination and supply, quality assurance and crucially, subsidy to ensure affordability and acceptance. If prices compare favourably to current treatments, this will ensure greater use (since users will pay) and will protect against the spread of counterfeit or poor quality drugs.

**Monitoring and Evaluation:**

Whatever the final policy is, it requires careful evaluation of effectiveness. The gold standard for this is the randomised controlled trial, although it may not be feasible in the arena private sector evaluation. Pre- and post-intervention evaluation is the second best assessment of policy, and this should be conducted in pilot provinces.

Inclusion of the private sector in disease monitoring may add additional data to the patterns of disease, and will be an important component of surveillance as efforts to eliminate malaria take effect.

It is recommended to use some selected private sector clinics are included in the National Malaria Sentinel Surveillance System.

**Further research:**

Survey data such as this provides a useful “range-finder”. More detailed information can be gathered from in depth surveys, observation of practice and well conducted focus-group discussions. This should form a component of policy development. This will allow consideration of decision making in private practice.

Further investigation of treatment seeking behaviour is required, as it can often be seen as a continuum of decisions. Investigation of the decision making process is required. Investigation of decision to diagnose and treat patients requires further investigation to define and improve on the number of patients correctly treated.
Malaria Sentinel Surveillance in Afghanistan

Toby Leslie, Nader Mohammed, Hafiz Omar, Haroon Ur Rasheed, Frits van der Vorst, Abdul Majeed Sediqi

HealthNet-TPO.

Abstract:

Introduction: Prospectively collected surveillance data, if reliable, provides a powerful tool for monitoring disease trends over space and time. In the setting of malaria monitoring in Afghanistan it is particularly appropriate, since the epidemiology of malaria varies by location, season and species of malaria. This approach has advantages over cross-sectional surveys which are costly and require large sample sizes to generate useful data.

This surveillance program – the National Malaria Sentinel Surveillance System – is designed to monitor disease trends, nationally, with the aim of providing a baseline, monitoring progress in reducing transmission and detecting epidemics. This report summarises the achievements of GF Round 5, Phase I in developing the system. Interim data analysis is conducted and recommendations made for improvement of the system.

Methods and results: Twenty sentinel sites were established at ~100km distance from each other, across the country. This selection strategy yielded Malaria Reference Centres (n=4), Regional Hospital (n=1), Provincial Hospitals (n=12) and District Hospitals (n=3). Surveillance was conducted in out-patients departments, facility laboratories and in-patients departments. Data on malaria cases stratified by age, sex and pregnancy was collected, and number of deaths in IPD. Data was reported weekly from each site to HN-TPO, Kabul. From 2nd May to 23rd October, 5,172 cases were detected, 93.6% of which was vivax malaria from 344 reports. As expected incidence varied widely by site with some reporting 0 cases. The highest case-numbers were in Hilmand province.

Conclusions and recommendations: The project has broadly reached its aim with the considerable achievement of setting up a national surveillance network. There are a number of improvements that need to be made following implementation. In particular, the lack of quality control data on diagnostic accuracy makes results difficult to interpret. Poor microscopy may over or under estimate the true case numbers and it is not possible, at this time, to correct for this factor during the analysis. In addition, widespread differences and/or changes in healthcare utilisation may show spurious differences in case-numbers. Additional variables need to be collected at facility level, amongst which should be the number of OPD consultation and number of IPD admissions required. Data analysis and reporting needs to be done regularly and reports sent up and down the chain. Training is required. During the next phase of the project, changes will be made to improve and standardise data collection and analysis.

Once the system is collecting the correct data and is running in a standardised way, this system will provide a cost-effective tool in measuring program success, detecting epidemics and focusing resources on areas of need.
Introduction:

Prospectively collected disease surveillance data provides a powerful tool for monitoring disease trends. It has several advantages over cross-sectional surveys in the epidemiological setting of Afghanistan; it is more efficient, easier to implement and can be more accurate than field surveys. With the seasonal nature of malaria in Afghanistan, temporal trends provide accurate information for those working in malaria control; interventions can be timed correctly to ensure maximal effect.

Malaria epidemiology in Afghanistan is complex; two species of parasite coexist. *Plasmodium vivax* is the predominant species, causing approximately 85-95% of malaria cases. *P. vivax* is considered relatively benign because severe disease or death is rare. However, it causes considerable morbidity and is associated with severe anaemia, and impaired development in children. Its ability to infect liver cells and cause relapse means that for each initial infection a person is at risk of further episodes (up to 10) over months or years without the bite of an infective mosquito. The second (and minor species), *P. falciparum*, can be fatal and is prone to epidemics. Most cases are mild to moderate, but if not promptly treated, or in vulnerable persons (the young, pregnant, malnourished or immunocompromised) may progress to severe and life threatening disease. In Afghanistan, disease transmission is seasonal and follows a trend in all sites which have been examined. *P. vivax* typically shows two peaks – in the spring (likely to be a surge of relapses since vector abundance does not coincide with case numbers) and in the summer months, when vector abundance is sufficient to promote transmission of the disease. *P. falciparum* peaks in the late summer and into the winter (typically from August-December). Sporadic cases may be seen at other times of the year and the country is also at risk of epidemics, which have been recorded in the past.

In addition to the seasonal patterns of the two coexistent species, transmission is geographically constrained to areas below ~2000m above sea level and where land surface temperatures and ecological niches are suitable for vectors. Figure 1 shows approximate areas at risk from malaria transmission. This epidemiological situation is classified (globally) as hypo-endemic. In most endemic areas, the force of transmission is not sufficiently high to make the disease a significant cause of febrile illness – typically 20-30% of blood slides are positive for parasites – although it is still a significant health problem and requires sustained control to maintain low levels of transmission.

Currently, malaria control in Afghanistan is being brought to a nationally coordinated scale. The program principally relies on the distribution of long-lasting insecticide treated nets, targeted at high
transmission areas. Additional efforts are being made to promote accurate diagnosis, prompt and effective treatment and health education and awareness through the public health system (BPHS).

![Figure 1: District level risk of malaria transmission.](image)

Sentinel surveillance of disease is considered a cost-effective method of collecting prospective data on disease trends. It is a useful tool in monitoring overall disease trends at national (or sub-national levels). Its methods are limited by the boundaries of facility catchment areas meaning that what happens in between is not recorded. Additionally, estimates of catchment population may be unreliable and healthcare usage patterns unknown, making absolute measure of incidence problematic. It may be associated with selection biases, since it only records the number of cases presenting at specific health facilities, which may differ from the population as a whole. Despite these shortcomings, it can be used to measure disease trends and if the correct information is collected it can provide useful information. It can also act as a tool in epidemic detection and response.

There are significant shortcomings in the current disease monitoring system for malaria. Health Management and Information Systems currently in operation for the BPHS does not measure data at the required level for use. For example, no age or sex specific data is collected. Delays in reporting also prevent timely assessment of data required for efficient resource allocation and epidemic response. With the renewed interest in malaria eradication and elimination, disease surveillance plays a vital role in allocation of resources and timely reporting.

In this report, data from sentinel surveillance at 20 sites across Afghanistan is
analysed. The report also contains formats for reporting in the future and suggestions for improvement of data collection, processing and reporting.

**Goal:**

To develop a functional national sentinel site surveillance system in Afghanistan, focusing on malaria to produce quality data in a timely manner.

**General objective**

To monitor nationwide trends of malaria morbidity, mortality and transmission patterns

**Specific objectives**

- To develop an integrated system for malaria surveillance
- To monitor trend of malaria morbidity in the country
- To monitor trend of malaria mortality in the country
- To strengthen the national malaria early detection for outbreak management

**Methods:**

**Sentinel site selection:**

An assessment of the trends in patients attending the selected health facilities was conducted in 20 sentinel sites all over Afghanistan. These sites are selected from health facilities which are within the radius of 20 evenly distributed 50 Km-radius circles. Each site therefore has a minimum of 100 kilometre distance to others (figure 2). Each circle had one Sentinel Site selected based on the following characteristics:

1. Capacity to perform the tasks of a sentinel site such as lab diagnostic capabilities (assessed by pre-set inventory), trained technicians, and auxiliary staff.
2. Easy accessibility and good security
3. Manage both uncomplicated and complicated cases (except MRCs).
4. Have a catchment population >50,000
5. Phone coverage - for electronic reporting.
6. Electricity for computers, lab microscopy, and internet.

If more than one site conformed to the characteristics, the highest level of the health system was selected.
Study subjects and data collection:

The population of interest consists of all those people living under coverage of the Sentinel Site. Study subjects comply with the case definition of malaria or suspected malaria and comprise all febrile individuals of any age and sex who are sent to the lab of health facilities for a malaria blood smear. Thick and thin giemsa-stained blood smears are prepared by trained laboratory technicians. These are examined under light microscopy by trained microscopists and results are recorded in a register at the lab of the health facility. Results are given to the patients who referred to a doctor for treatment. Information on sex, age under or over 5 and pregnancy status are also recorded.

In order to maintain high quality of diagnosis, the lab technician should keep all the slides examined. A joint team of HealthNet TPO and NMLCP should collect the slides on a regular basis and bring them to Kabul. All falciparum positive slides or
those with mixed infection, 10% of vivax positives and 10% of negative slides should be read by expert microscopists from HealthNet TPO and NMLCP. Feedback will be given to the sites, and implementer on the quality of diagnosis and refresher training given to microscopists whose accuracy drops below 95%. Annually, NMLCP will report in general on the quality of the sentinel sites to other partners.

The sentinel site collects information throughout the year, although in this report only the initial data is presented. Basic analysis should also be conducted at the sentinel site to be used for patient management, assignment of resources and local disease control activities. Results from this surveillance are sent to the centre in Kabul, weekly, for further analysis and communication.

HealthNet TPO monitoring unit should receive electronic reports on specially designed format from sentinel sites, weekly, for monitoring trends over time both at the field and national level. The reports are collated, organized and analyzed at the national level and regular monthly feedback should be provided both to the MoPH, NMLCP, the field and to the Vector Borne Disease Task Force.

The data analysis should take place at two levels; the sentinel site staff collect and compile data and perform the basic analysis to look for the trends of the disease at the sentinel site level. Information is used at central level to examine national and regional level trends. Information collected at national level should be used as a basis for improved program management at all levels.

**Data Analysis:**

The following indicators are used for analysis (Table 1).

<table>
<thead>
<tr>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of reports received (completeness and timeliness of reporting table)</td>
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</table>

**Malaria in children 5 years an older**

<table>
<thead>
<tr>
<th>Number of new cases in all age and sex groups (frequency table for children &gt;=5 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of new cases in all age and sex groups (percentage table for children &gt;=5 years)</td>
</tr>
<tr>
<td>% of positive slides for PF (percentage table for children &gt;=5 years)</td>
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<tr>
<td>% of positive slides for PV (percentage table for children &gt;=5 years)</td>
</tr>
<tr>
<td>% of positive slides for Mixed (percentage table for children &gt;=5 years)</td>
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**Malaria in Pregnant Women**

<table>
<thead>
<tr>
<th>Number of new cases in pregnant women (frequency table for pregnant women)</th>
</tr>
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<tr>
<td>% of positive slides for PF in pregnant women (frequency table for pregnant women)</td>
</tr>
<tr>
<td>% of positive slides for PV in pregnant women (frequency table for pregnant women)</td>
</tr>
<tr>
<td>% of positive slides for Mixed in pregnant women (frequency table for pregnant women)</td>
</tr>
</tbody>
</table>
Malaria in children <5 years

Number of new cases in children < 5 years (frequency table for children < 5 years)
% of new cases in children < 5 years (frequency table for children < 5 years)
% of positive slides for PF in children < 5 years (frequency table for children < 5 years)
% of positive slides for PV in children < 5 years (frequency table for children < 5 years)
% of positive slides for Mixed in children < 5 years (frequency table for children < 5 years)

Malaria in different age and sex groups

Number of new cases in all age and sex groups (frequency table)
% of new cases in different age and sex groups (percentage table)
% of positive slides for PF in different age and sex groups (percentage table)

Quality of practices

Percentage tables of the results of crosschecking and monitoring (% table of false positive and falsely negative)

Data points are also plotted over time at national and local levels, as well as by risk strata and facility type.

Results:

Implementation:

In total, 354 reports were received from week 18 to 42 of 2008. Data collection began on 2\textsuperscript{nd} May 2008. Here date until 23\textsuperscript{rd} October is presented. Implementation of surveillance was staggered. Table 2 shows the week of the first report of each site. By week 35, 20 sites were reporting.

<table>
<thead>
<tr>
<th>Sentinel Site</th>
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</table>
Table 3 shows an overview of facilities:

<table>
<thead>
<tr>
<th>Name</th>
<th>District</th>
<th>Province</th>
<th>Approx Catchment Pop</th>
<th>Province Risk Strata</th>
<th>District Risk Strata</th>
<th>Facility Type*</th>
<th>Report Start Date</th>
<th>Number Reports Received</th>
<th>Number Missing Reports</th>
<th>Report %</th>
<th>QA</th>
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<td>2</td>
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<td>2</td>
<td>PH</td>
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<td>1</td>
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<td>3</td>
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<td>10/5/08</td>
<td>19</td>
<td>5</td>
<td>79.2</td>
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</tr>
</tbody>
</table>

* MRC = Malaria Reference Centre; PH = Provincial Hospital; RH = Regional Hospital; DH = District Hospital.

Data was collected from 3 sections in the facility, where available:

- **Out-patients Department (OPD):** Recorded all cases reporting with malaria, whether their diagnosis was from the facility or from an external source (i.e. other clinic, private sector). Cases were recorded by sex, pregnancy and aged under or over 5 years of age.

- **Laboratory:** Each facility laboratory noted all cases where a diagnosis was made in the facility. This excluded those who had a diagnosis elsewhere. The lab recorded the total number of slides examined (TSE), in addition to sex, pregnancy and aged under or over 5 years of age.

- **In-patients department (IPD):** Each facility with an IPD recorded the number of deaths attributed to malaria, by sex, pregnancy and aged under or over 5 years of age (not available at MRCs).

For the purposes of this report, analysis is primarily based on data from the laboratory. This is because this data collection point provides only in-facility data, where quality can be assured.

**Sentinel Sites Data:**

A total of 5,172 cases were reported from laboratories in the sentinel sites. Of these, 93.6% were vivax malaria. Because implementation of the project was
staggered, different numbers of facilities were reporting data in each week. Therefore a denominator was used to provide a measure of cases per report. In total, there were 13.7 cases per report for vivax, and 0.1 cases per report for falciparum malaria. Slide positivity rate (SPR) varied considerably by week of report (range [Pv only]: 3.8-38.0%; Pf: 0.0-6.6%) (figure 3).

![Figure 3: Total cases per report for vivax and falciparum malaria per report (bars) and slide positivity rate (line; secondary axis), by reporting week.](image)

Weekly reports are summarized in figure 4a and 4b, showing weekly case-numbers reported by each site.
When viewed by sentinel site, expected differences are noticed - >70% of vivax cases were reported by 4/20 sites in Hilmand (31.8%), Khost (13.2%), Kunar (15.2%), and Nagahar (13.0%). These same provinces also have the highest proportion of falciparum cases (Figure 5a and 5b).
A: % of total Pv cases, by province:

<table>
<thead>
<tr>
<th>Province</th>
<th>% of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilmand</td>
<td>31.8</td>
</tr>
<tr>
<td>Kandahar</td>
<td>0.6</td>
</tr>
<tr>
<td>Khost</td>
<td>13.2</td>
</tr>
<tr>
<td>Ghazni</td>
<td>9.9</td>
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<td>Laghman</td>
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<td>Faryab</td>
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<tr>
<td>Bullah</td>
<td>0.0</td>
</tr>
<tr>
<td>Bullah</td>
<td>0.0</td>
</tr>
<tr>
<td>Bamyan</td>
<td>0.0</td>
</tr>
<tr>
<td>Balkh</td>
<td>2.2</td>
</tr>
<tr>
<td>Balkh</td>
<td>2.2</td>
</tr>
</tbody>
</table>

B: % of total Pf cases, by province:

<table>
<thead>
<tr>
<th>Province</th>
<th>% of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khost</td>
<td>41%</td>
</tr>
<tr>
<td>Faryab</td>
<td>0%</td>
</tr>
<tr>
<td>Ghorian</td>
<td>0%</td>
</tr>
<tr>
<td>Ghazni</td>
<td>6%</td>
</tr>
<tr>
<td>Farah</td>
<td>1%</td>
</tr>
<tr>
<td>Balkh</td>
<td>0%</td>
</tr>
<tr>
<td>Baghlan</td>
<td>0%</td>
</tr>
<tr>
<td>Badakhshan</td>
<td>2%</td>
</tr>
<tr>
<td>Badakhshan</td>
<td>2%</td>
</tr>
<tr>
<td>Nangarhar</td>
<td>10%</td>
</tr>
<tr>
<td>Nangarhar</td>
<td>10%</td>
</tr>
<tr>
<td>Andkhoy</td>
<td>0%</td>
</tr>
<tr>
<td>Andkhoy</td>
<td>0%</td>
</tr>
<tr>
<td>Laghman</td>
<td>2%</td>
</tr>
<tr>
<td>Laghman</td>
<td>2%</td>
</tr>
<tr>
<td>Kandahar</td>
<td>1%</td>
</tr>
<tr>
<td>Kandahar</td>
<td>1%</td>
</tr>
<tr>
<td>Khost</td>
<td>41%</td>
</tr>
<tr>
<td>Khost</td>
<td>41%</td>
</tr>
<tr>
<td>Nangarhar</td>
<td>10%</td>
</tr>
<tr>
<td>Nangarhar</td>
<td>10%</td>
</tr>
<tr>
<td>Andkhoy</td>
<td>0%</td>
</tr>
<tr>
<td>Andkhoy</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 5a & b: Proportion of cases of vivax (A) and falciparum (B) malaria reported by sentinel site.

Amongst children under 5, there were 1,383 cases of malaria, 94.9% of which was vivax. 27.1% of vivax cases were in children under 5 years and a similar proportion (21.0%) of falciparum cases were in this group. Approximately 60% of cases in
under 5 years of age were in males. See annex 2 for full data table.

There were 3 deaths reported from IPD, 2 attributed to vivax and 1 attributed to falciparum. None of these were in children under 5 or in pregnant women.

The proportion of cases caused by Pf changed according to the known seasonality of disease (Figure 6) with proportion rising from August onwards (week 30) as vivax incidence decreases and falciparum increases.

There were a total of 322 cases amongst pregnant women, 94.7% of which were due to vivax malaria. Ten percent of females with vivax malaria were pregnant, and 14.6% of females with falciparum were pregnant. In total, 3.7% of cases were pregnant.

Reporting success rate varied between sites (Table 2). Overall, reporting success was 82.3%. Six facilities had >90% reporting success and 6 facilities had reporting success rates between 80% and 90%. The lowest reporting rate was 38.5%.

Conclusions:

The implementation of the sentinel surveillance system has broadly reached its aims. It is a big achievement to set up and collect data on a national scale. However, there are a number of improvements that can be made to the current system to enhance its value for the future. These are discussed in the recommendations section, below.
The data indicate patterns of disease over a 6 month period. The staggering of the start and lack of quality control and assurance mean that data must be interpreted with caution. Until cross checking of diagnostics is conducted in all surveillance sites, and standardised procedures are used for data collection, the quality of the data cannot be guaranteed. Consistently poor quality microscopy may result in either chronic under or over estimation of malaria. Facilities reporting a very high SPR (e.g. Khost and Hilmand) require urgent quality checking (table 2). If the microscopist(s) are consistently giving false positives, this will give the impression of high malaria burden. However, if SPR is truly this high, then this is a pointer towards high malaria burden and a target for intervention. This illustrates the importance of quality assurance in any surveillance system and of timeliness of reporting.

Healthcare usage may differ widely by province. Availability of alternative health services, public perceptions of quality, socio-economic factors and, importantly, security all influence health seeking decisions. For example, if private sector usage is high in a particular region, case numbers may be consistently underestimated. In areas of insecurity, where population densities increase in secure areas due to displacement, case-numbers may be inflated above the real picture as people seek healthcare at major facilities, rather than locally. This illustrates the need to collect additional facility data, such as number of consultations or admissions to provide a reliable denominator. The range of data reported requires revision and expansion, with particular emphasis on denominators. Some suggestions are made below.

Surveillance systems are also vulnerable to inconsistent reporting. All sites are required to follow the same protocol and this requires repeated reinforcement and strong supervision by experienced managers.

The system should also provide timely data. This is the first analysis and reporting of the data for the six months of the project. Although this is still the nascent stage of the project, reporting should be regular and timely. Once established and fully functional, the sentinel surveillance system will provide valuable data on disease trends and allow measurement of program progress.
Recommendations:

Data collected:

The following variables should be added to the data-set:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Extra data to collect</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of OPD consultations over reporting period</td>
<td>Age, sex, pregnancy</td>
<td>Allows calculation of attributable fraction of consultations due to malaria. Provides a measure which is insensitive to the number of cases due to changes in the health service or population. Also assists in epidemic detection.</td>
</tr>
<tr>
<td>Number of OPD consultations for febrile illness</td>
<td>Age, sex, pregnancy</td>
<td>Allows calculation of attributable fraction of malaria to febrile illness. Also assists in epidemic detection.</td>
</tr>
<tr>
<td>Total IPD admissions over reporting period</td>
<td>Age, sex, pregnancy</td>
<td>Allows facility mortality rates to be measured.</td>
</tr>
<tr>
<td>Total IPD admissions for malaria</td>
<td>Age, sex, pregnancy</td>
<td>Gives case fatality rate at in-patients level.</td>
</tr>
<tr>
<td>Total IPD deaths</td>
<td>Age, sex, pregnancy</td>
<td>Allows attributable fraction of malaria to IPD mortality.</td>
</tr>
<tr>
<td>Number mixed infections</td>
<td>Age, sex, pregnancy</td>
<td>Mixed infections present specific challenges for case-management and epidemics of mixed malaria have occurred.</td>
</tr>
<tr>
<td>Further stratification of age group (0-1, 1-5, 6-10, 10-20, 20-40, &gt;40)</td>
<td>Sex and pregnancy</td>
<td>Allows assessment of age burden, and potential targeting of interventions.</td>
</tr>
<tr>
<td>Collection of same age, sex, pregnancy data for negative slides</td>
<td>-</td>
<td>Allows risk factor analysis on sex, age and pregnancy at facility level.</td>
</tr>
</tbody>
</table>

- Consideration of expansion to some CHCs within the catchment areas of sentinel sites to estimate changes in healthcare usage.

Quality Control and Assurance:

- Cross checking of slides, according to the protocol, by expert microscopists is urgently required. Data quality cannot be assured without this component.
- Microscopists who fall below 95% accuracy require refresher training.
- All microscopists should use the same WHO standard microscopy techniques.
- Data quality assurance is required by use of standard reporting procedures.
- Periodic audit of each facility should be conducted to verify the quality of work.
- Specific incentives for performance may provide additional motivation at the sentinel sites to enhance reporting rates and improve quality of data.
- Upgrading of data record forms to include new variables for standardised reporting and ease of data entry.
Data Analysis:

- Better organisation of data-sheets is required.
- Standard data analysis tools are required, using MS Access or similar program to generate reports automatically. Options to generate different types of reports should be included, using this analysis as a template.
- Specifically the system:
  o Should be capable of automatically generating reports of weekly, monthly, 6 monthly and annual data according to pre-set indicators, by site, region, risk strata and/or facility type.
  o Use double entered data
  o Use standard reporting templates
  o Have a dedicated staff member to manage the component.
- Capability for local level analysis.
- Additional data collected about the facility, e.g. local availability of alternate health services; population changes in the catchment area (such as internal displacement, or returning refugees).
- Prospective data analysed annually and used for risk mapping, and modelling of disease trends.

Information Flow:

- Information should flow more regularly from field to monitoring unit at central level. This should be conducted weekly, including data entry.
- Information should be processed using the database in the week following.
- Reports should be distributed to stakeholders on a weekly, monthly, 6 monthly and annual basis, by email or internet user-group.
- Reports should be distributed down to provincial level MoPH and NGOs, as well as to central level.
Vector Surveillance in Nangahar Province, Afghanistan; June – October 2008

Toby Leslie1,2, Nader Mohammed1, Hamid Rahman1, Abdullah Abdullah1, Abdul Rauf1, Mark Rowland2

1 HealthNet TPO, Kabul, Afghanistan.
2 London School of Hygiene and Tropical Medicine, London, UK.

Executive Summary:

Introduction: Entomological surveillance is an important component of malaria control programs implementing vector control strategies. With the influx of large numbers of insecticide treated nets into Afghanistan under the Global Fund Round 5 grant, entomological surveillance is important to give information on effectiveness and targeting. No recent data exists on malaria vectors in Afghanistan, with the last being conducted in 1995/6. Measuring infection rates using enzyme linked immunosorbant assay (ELISA) in mosquitoes also provides a useful measure of transmission rates.

Methods and Results: Five separate collection techniques were use to conduct surveys in 4 different ecological zones in and around Jalalabad city in Eastern Afghanistan. Rice growing areas, non-rice crop agricultural land, river margin and peri-urban areas were surveyed from 15th May 2008 to the present. Here data from 1st June-31st September 2008 is presented.

Anopheles stephensi was confirmed to be the most abundant vector in the study area. This finding is reflected by all collection methods and confirms the findings of the most recent study – in 1996. In addition to the majority A. stephensi, species composition changed throughout the year with A. splendidus, A. pulcherimus and A subpictus seen in June, August and September, respectively. Using space-spraying methods - use of aerosolised non-persistent insecticides in the early morning to kill and collect mosquito specimens - revealed that anopheles mosquitoes were the predominant species in animal rooms and in human sleeping rooms. Anopheline abundance was 5 times higher in animal rooms. Species composition did not differ between animal rooms and human sleeping rooms.

Anopheles species were found in all ecological zones. Abundance was highest in rice growing areas during July and August – in coincidence with the irrigation of paddy fields. A splendidus was seen in major proportion in June in river margins, while A subpictus was seen in September in non-rice growing areas. In peri-urban areas, A stephensi was almost exclusive. Using outdoor cattle-baited net traps, culicine mosquitoes predominated. Anopheles mosquitoes were found in minor proportion with low numbers seen. However, species composition appears to be more diverse than those collected by space-spraying although A. stephensi was again the dominant species.

Conclusion and Discussion: Mosquito ecology in and around Jalalabad appears to have changed little in the last decade. A. stephensi maintains its place as the dominant malaria vector, although other species with known vectorial capacity are also evident. The high density of anophelines in animal sheds and sleeping room indicates that human-vector interaction is potentially high. The highest densities are seen in animal sheds and in rice growing areas in the months of July and August. This identifies potential vector control targets.

Introduction:

Entomological surveillance is an important component of malaria control efforts. Differing areas of malaria endemicity often have diverse species composition. The different species may have different individual ecologies and different feeding
and resting behaviour. Some may be important as vectors of malaria, others may serve as a stimulus for bed net use. Gaining an understanding of the local mosquito fauna is of interest in providing information for more effective targeting of insecticide treated nets (ITNs) against malaria and for other vector control strategies.

Since personal protection using insecticide treated nets (ITN) is a core strategy of malaria control efforts, recent data on malaria vectors is needed. Efforts to increase coverage of insecticide treated nets (ITN) for malaria control in Afghanistan are advancing; approximately 1.2 million ITNs are to be delivered and distributed in the country by the end of 2008 and in the coming three years an additional 1 million will be delivered through funding from the Global Fund for AIDS, TB, and Malaria. In some areas of Afghanistan ITN use has been in place for a decade or more (e.g. Nangahar Province), whereas in other areas ITNs have not been used (due to lack of availability) (Unpublished Program Reports; Kolaczinski et al, 2005). Vector control in Afghanistan has, and continues, to rely heavily on pyrethroid insecticides – predominantly deltamethrin. ITNs due to be distributed are of the long lasting type (LLITN) (PermaNet 2.0™, Vestergaard-Franzen, Denmark), which use deltamethrin for their action to control malaria. It is also planned to use this insecticide to implement a large scale re-impregnation campaign of existing conventionally-treated nets using long lasting treatment kits. ITN trials have previously demonstrated effectiveness in controlling both malaria (Rowland 1999; Rowland et al 1996, Rowland et al 1997) and leishmaniasis (Reyburn et al 2000). In addition, impregnation of chadors (head-scarves) and treatment of livestock with pyrethroids has been employed as a control tool (Rowland et al 1999; Hewitt and Rowland 2001).

Although some studies have shown the predominant vector in Afghanistan to be Anopheles stephensi in the East of the country (Rowland et al, 2002), there is no recent entomological data from the Eastern region, and none from the last 20 years in the rest of the country. Other species may be drivers of ITN use. For example Culex is an importance nuisance mosquito and is resistant to pyrethroids in most parts of the world. There is no data on insecticide susceptibility, which forms a vital component of any vector control component of control programmes. The principle aim of this study was to conduct vector surveillance, and, in stages, establish a baseline level of insecticide resistance using the standard WHO bioassay technique. The study aims to conduct longitudinal surveillance, and is the pre-cursor to a national vector surveillance programme.

Also of interest is the sporozoite positivity rate in wild caught anopheline mosquitoes. Although this provides an incomplete measure of vectorial capacity, a measure of baseline sporozoite rate will allow monitoring of success in reducing
transmission of disease over the coming years using follow-up surveys.

**Aims of the component:**

- To monitor anopheline species composition in Afghanistan over the course of one year.
- To establish differences in anopheles density related to ecological zone.
- To determine which species are the main drivers of bed net use.

**Methods:**

**Study Sites**

Nanghahar province is characterised by ecologies suitable for anopheles mosquito breeding. In order to access a wide variety of ecological settings 4 “ecological zones” were selected:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice growing area</td>
<td>District Village</td>
</tr>
<tr>
<td>Non-rice crop growing area</td>
<td>Behsood Qila Ali</td>
</tr>
<tr>
<td>River margin</td>
<td>Batikot Chardhi</td>
</tr>
<tr>
<td>Peri-urban</td>
<td>Surkhrod Bagrami</td>
</tr>
<tr>
<td></td>
<td>Behsood Farm Hadda</td>
</tr>
</tbody>
</table>

Sites were selected based on local knowledge of land-use. Within each ecological zone, three compounds were selected for field collection of adults. Inclusion criteria for the compound(s) were:

- Informed consent of head of household
- Livestock (animal) shed present
- Livestock present
- Major domicile (i.e. humans living permanently in the compound)

**Vector Sampling Techniques:**

Four sampling techniques were employed:

- **Space spraying:** A non-persistent insecticide was sprayed in the main sleeping room of houses and animal sheds at dawn on pre-selected days (Annex). Sheet collection methods will be used to collect samples for later use in assessing mosquito density and species identification. Six houses were selected in each sites and two rooms, one sleeping while one animal room, were space sprayed for this purpose. Those houses were visited in each month to collect mosquitoes. Mosquitoes were preserved in the tube containing silica gel, labeled and brought to the laboratory for further analysis.

- **Cattle baited net catches:** A giant animal net was used to collect mosquitoes. Two cows were kept under the net over night on pre-selected nights (annex). The collection of mosquitoes was conducted for 12 hours, over night. Live samples were collected for later use in species identification.

- **CDC Light-traps:** CDC light traps were hung inside sleeping rooms, in animal
sheds and outside the compound from dusk-dawn on pre-selected nights (annex). Samples were collected after dawn for later use in sporozoite analysis and species identification.

- Larval Sampling: Mosquito breeding sites in each ecological zone were examined by field teams. Those found to have anopheles larva were included in the survey. Anopheles larva will be collected from each site and bred to adulthood for later insecticide resistance testing.

**Laboratory Procedures:**

**Sample Processing:**

All samples were processed in the same way.

- Species was identified, noting the method and location and date of collection.
- Samples have been stored in batches, by species, method, location and date of collection for ELISA testing.

**Species Identification:**

A standard key was used to define the anopheline species collected. Samples will be examined by two entomologists.

**Results:**

From 15th May 2008 surveillance has been ongoing until the present. Here, prospectively collected data from 1st June 08 – 31st September 2008 (4 months) are presented. Four separate ecological zones have been surveyed – river margin, peri-urban, rice and non-rice growing agricultural land. The surveillance protocol below has been followed by trained entomologists and assistants using the methods described above.

Figure 1 shows relative abundance of both culex and anpholeles mosquitoes from all sites using all collection methods. The abundance of mosquitoes is dominated by culicines, which are not transmitters of malaria. Their importance, medically, is negligible in Afghanistan. However, their importance in malaria control is not to be underestimated, since they are considerable nuisance biters and are likely to drive the use of ITNs.
Anophele mosquitoes peak in abundance in July with abundance reduced in August and September. Abundance rises from approximately 1000 specimens to 3000 between June and July. Culicine mosquitoes appear to show more uniform abundance throughout the summer season.

Analysis of species composition amongst anopheles mosquitoes shows that $A.\text{stephensi}$ remains the dominant species (figure 2) comparing well to the findings of Rowland et al. from surveillance conducted in 1995/6 in Nangahar province. In June, 30% of anophelines were $A.\text{splendidus}$. In September, the abundance of $A.\text{subpictus}$ increased to 12% of the total.
Due to the different behaviours of different mosquito species, mosquito abundance differs by collection method. In the above analysis all collection methods were assessed. To gain a more reliable picture of anopheles, the main assessment is based on data collected by space spraying or flitting. This is an acknowledged method for anopheles collection, and also provides data on human-mosquito interaction. In this surveillance protocol space spraying was conducted in animal sheds and sleeping rooms. Figure 3 shows that in animal sheds and sleeping rooms, anopheline mosquitoes are the dominant species from June-August.
Figure 3: Total mosquitoes caught by space spraying at all sites.

Most anopheles mosquitoes were caught in animal sheds (figure 4), with a ratio of 5:1. This is also indicated by the relative abundance of *A. stephensi*, which is known to be zoophilic (figure 5).

Figure 4: Catches of anopheles mosquitoes by space-spraying in animal rooms and sleeping rooms at all sites.
Although abundance in animal sheds was far higher than in sleeping rooms (figure 4), the species ratios in animal sheds did not appear to show major differences from that in sleeping rooms (figure 6).

When assessed by ecological zone, differences in composition and abundance are observed (figure 7). At river margins and in rice growing areas, anopheles species are more abundant that culicine mosquitoes. A rapid increase in vector numbers is seen in rice growing areas in July and August, coincidental with the irrigation of rice.
paddies. In non-rice growing areas and peri-urban setting, culicines account for the majority of observed mosquitoes, with a rise in August and September.

![Figure 7: Relative abundance of anopheles and culex mosquitoes collected by space spraying by month and surveillance site. B= Bagrami ; C= Chardhi; FH= Farm Hadda; QA = Qila Ali.](image)

In all ecological zones and in all months except June in river-margins, *A. stephensi* is the predominant species (Figure 8). In June at the river margin the predominant species is *A. splendidus* which is known to breed in this environment although its role as a vector is not well defined. Relative abundance reduces over July and August until minimal numbers are seen in September. In July in the rice field area *A. pulcherrimus* is abundant. This species was once very common in the rice fields of northern Afghanistan (e.g. Kundus) and is believed to be the major malaria vector there. In Nangahar it appears to be subordinate to *A. stephensi*. Surveys in northern Afghanistan have not been since the 1970s and is a priority.

In September in areas of non-rice crops, *A. subpictus* is seen to increase in abundance. This species has been implicated as an important vector in parts of South and Southeast Asia, and were seen in high numbers during an outbreak of falciparum in the Kurram Tribal Area of Pakistan (adjacent to Khost Province) in 2004 although full incrimination studies were not conducted. The species is known to breed in muddy pools and borrow-pits, and to breed later in the season than other potential vectors. It is notable that the rise in abundance is coincidental with the known falciparum season in Afghanistan (Late August-December). *A. subpictus* is also seen in September in river-margins and in rice growing areas in minimal proportions.
Peri-urban areas are dominated by *A. stephensi* throughout the observation period, although relatively few are found. This dominance may be related to the number of households in these areas who keep livestock, as well as the preference of *A. stephensi* for urban breeding sites. Whereas *A. stephensi* is an urban vector in India, in Iran it is a rural vector. Afghanistan may mark a transition zone with *A. stephensi* present in both urban and rural areas.

Use of cattle baited net catches recorded culicine mosquitoes to be in greater abundance than anophelines (figure 9). Abundance of all mosquitoes was higher in rice growing areas compared to other ecological zones. There appears to be a Culex species associated with rice that feeds on cattle. It is not yet clear whether this is the *Culex quinquefasciatus* species that more conventionally found in urban areas. Interestingly the relative abundance of *Culex* was much less common in the rice zone using the space spraying method.
Although overall abundance appeared lower for anophelines using this method of collection, species composition broadly mirrors that of space-spraying (figure 10) with *A. stephensi* being the predominant species found. There are differences in abundance amongst the minor species – the exophilic (outdoor resting) *A. hyrcanus* is only seen in cattle baited traps (circumstantial evidence also suggests that it may breed exclusively in rice fields). Other comparisons are hampered by small collection sizes which prevent detailed comment.

Figure 9: Culicine and anopheline mosquitoes caught in cattle baited net traps by ecological zone and month.

Figure 10: Species composition of anopheline mosquitoes caught by cattle baited net traps, by site and month. Note: Only 1 specimen (*A. annularis*) was caught in August in C (Non-rice).
Conclusion and Discussion:

The data shows a comparable species profile to that of a similar survey conducted in 1995/6 (Rowland et al, 2001) showing that vector ecology has changed little in the last decade. The predominant anopheles mosquito seen is *A. stephensi* in all zones. By all methods, culicine mosquitoes are in greater abundance than anophels. Anopheles abundance is found to be highest in rice growing areas, peaking with the flooding of paddy fields and in animal sheds. *A. pulcherrimus* and *A. hyrcanus* appears to be associated with rice growing areas.

Space spraying of animal rooms and sleeping rooms provides the best measure of potential human-mosquito interaction and thus, malaria transmission. Anopheline species were in greater abundance than culicines by this method. The relative abundance of anophelines was approximately 5 times higher in animal sheds than in sleeping rooms, providing a potential target for vector control and reflecting the zoophilic nature of *A. stephensi*.

During this round of surveillance, from May-September 2008 it has not been possible to run insecticide resistance tests. However, larval catches have yielded wild type mosquitoes which are being bred at the entomology laboratory in Jalalabad. Additionally, sprozoite ELISA testing will be conducted in 6 month batches. Capacity for in-country testing has been established through training and use of existing laboratories in Kabul (managed by the Afghan Public Health Institute / NAMRU-3).

This data represents four months of surveillance at the peak of the mosquito season. However, the additional eight months of data (to end of May 2009) will provide a complete dataset. Along with the insecticide resistance and ELISA testing this will provide a comprehensive vector surveillance model which can be implemented at additional sites. Plans for expansion of this protocol to the North of Afghanistan (Kunduz province) will provide additional data into Afghanistan's mosquito ecology and vector abundance. This will also allow monitoring of interventions for vector control.

References:


malaria in Afghan refugees. Transactions of the Royal Society of Tropical Medicine & Hygiene. 90, 357-361.
A Baseline Survey of Malaria in Pregnancy in Eastern Afghanistan

Toby Leslie, Hafisa Hamka, Dr M Nader.

HealthNet TPO, 2004

Executive Summary:

Introduction: In Afghanistan there is a general lack of knowledge on the epidemiology of malaria in pregnancy and its effect on maternal morbidity and neonatal birthweight. Afghanistan has one of the worst mother and child mortality and morbidity rates in the world. There is an urgent need to define a baseline prevalence of maternal malaria, anaemia and low birthweight against the seasonal epidemiological setting of malaria in the country. Malaria in Afghanistan is caused by two species, predominantly *Plasmodium vivax* (~70-90% of cases), with the remainder being due to *P. falciparum*. The mainstay of malaria control is with the use of personal protection methods, such as insecticide treated bed nets and insecticide treated materials (e.g. chadors). The objectives of the study were to define a baseline for malaria prevalence amongst pregnant women, assess the effect of malaria on maternal anaemia and birth weight, and examine knowledge, attitudes and practices amongst pregnant women toward malaria, pregnancy and malaria prevention. This is with the aim of developing an integrated strategy for reducing rates of malaria and anaemia and low birthweight caused by malaria as part of the Safe Motherhood Initiative.

Methods and results: Three surveys were conducted in order to establish baseline prevalence and investigate the effects of malaria in pregnancy:

A cross-sectional prevalence and knowledge attitudes and practices (KAP) survey was conducted in four districts (Shinwar, Momandara, Batikot, and Nazian) in Nangahar Province in the Eastern region of Afghanistan. 500 pregnant women were enrolled in the survey with each answering a standardised, pre-tested questionnaire to assess socioeconomic status, attitudes and practices towards pregnancy, malaria and its prevention and attendance at clinics. In addition each woman had a malaria blood smear examined and haemoglobin measured. The vast majority of those questioned had had no formal education, despite which knowledge of malaria was shown to be very high. The chief decision maker for treatment seeking was the father/husband. Most women had attended at least one antenatal clinic (ANC) during their pregnancy – probably because the study was conducted in areas where ANC services are available. The majority of those questioned reported using public (i.e. NGO/Government) health services, in contrast to the findings of a recent survey. Point prevalence of malaria was 3.9/1000 (95%CI 0.98-15.8/1000), while prevalence of anaemia was 383/1000 (95%CI 317-464/1000) and severe anaemia (Hb>7) was 34/1000 (95%CI 18-49/1000). Older women, and those in the 3rd trimester of pregnancy were more likely to have anaemia (AOR = 3.1 (1.2-7.7) and AOR 1.5 (1.0-2.2), respectively).

A survey conducted at the time of delivery in the Ghani Kheil Hospital enrolled 518 women, the majority of whom were aged 15-20 years (40.8%). The study measured rates of anaemia, malaria, and low birthweight. Also measured was the prevalence of intestinal parasites (as a confounding factor for anaemia). Point prevalence of anaemia was 346/100 (95%CI 305-388/1000), and prevalence of low birth weight (<2.5kg) was 107/1000 (95%CI 80-134/1000). No cases of malaria were detected in this group. Primigravidae were more likely to produce low birth weight babies than other groups. None of the following factors were associated with greater risk of anaemia in this sample: age, gravidity, or presence of intestinal parasites. Low birth weight was not associated with anaemia.

A case-control study was conducted at 8 health facilities in Nangahar and Laghman provinces. A total of 1212 women were enrolled in the survey. A case was defined as a woman of child bearing age with microscopically confirmed malaria and a control was a woman with symptoms that lead the physician to suspect malaria, but
whose blood slide was negative. A total of 284 (23.5%) were pregnant at presentation, and 143 (11.8%) were defined as cases. Use of insecticide treated bed nets (ITN) were negatively associated with malaria risk (OR 0.48, 95%CI 0.30-0.75), and older age groups were more likely to have malaria (OR in age group 26-30 – 2.92, 95%CI 1.14-7.48). Neither pregnancy (OR 0.92, 95%CI 0.57-1.49), nor gravidity were associated with increased risk of malaria.

An additional field test of WHO designed colour charts for measurement of haemoglobin, compared to conventional methods using a photometric (HemoCue) method was carried out. The results showed a sensitivity and specificity for the colour charts of 37% and 75%, respectively. There was a significant difference in the mean haemoglobin measured by the colour charts vs HemoCue (Mean Hb=11.4 vs 11.6, respectively, Ttest p=0.03).

Conclusions and recommendations: The reduction in malaria incidence recorded across the region in the last 2-3 years contributed to the low malaria prevalence detected in the cross sectional survey. The low prevalence hindered thorough assessment of the effects of malaria in pregnancy. However, the high rates of maternal anaemia and low birth weight detected suggest that factors other than malaria are most likely to be the major contributing factors to these morbidities. It seems most likely that a generally poor diet and poor access to dietary supplements are the major contributory factors.

The KAP survey revealed that sustained public health education campaigns can be very successful, even when the target population is largely uneducated. Knowledge of malaria was very good, despite very low levels of female literacy; a result of continued public education campaigns. However, it is important, and a strong recommendation, that males be included in education campaigns concerning mother and child health since the majority of treatment seeking decisions are taken by fathers/husbands, and not mothers.

It is unlikely that the implementation of intermittent presumptive treatment for malaria would be successful; firstly, those questioned reported that they would never take medication to prevent malaria whilst pregnant with the majority believing this to be unsafe. Secondly the prevalence of malaria does not appear to merit such an intervention. However, the prevalence of malaria detected is high enough to merit the use of specific interventions. The use of ITNs is demonstrated to reduce the risk of malaria, and is an acceptable intervention for the community. Efforts need to be made to make this intervention more accessible (cheap or free) to pregnant women, since the majority of those who did not own an ITN cited cost as the major barrier to access (95%). One method of doing this is to offer vouchers at antenatal clinics, which can be redeemed for free (or very highly subsidised) ITNs at existing outlets.

The high levels of maternal anaemia and low birth weight detected in these surveys are a serious cause for concern and warrant a) further studies into the causes, and b) specific interventions, such as promotion of nutrition and dietary supplements. It is recommended that a country-wide strategy be adopted.

Key recommendations for reduction of malaria in pregnancy, and improvement of mother and child health are:
- Adoption of countrywide education strategy for malaria in pregnancy and promotion of MCH, which includes males (fathers/husbands) in the target group.
- Increase awareness and use of appropriate interventions to reduce rates of maternal anaemia.
- Adoption of ITNs as the main preventative measure, with targeted distribution through ANCs using a voucher system.
- Increase use of ITNs in the home by pregnant women.
Introduction:

Malaria in Afghanistan:

There are an estimated 16 million people living in areas of malaria transmission in Afghanistan (Map). Transmission is seasonal and the product of two species. *Plasmodium vivax* accounts for 70-90% of cases with the remainder caused by *P. falciparum* (Rowland et al. 1994, Rowland et al. 1999). *P. vivax* cases are seen throughout the year, with a peak in incidence in the summer months. *P. falciparum* cases are seen over the winter months, usually from September to February (Fox & Strickland, 1989, Rowland et al 2002). The major vector in Pakistan and Afghanistan is thought to be *Anopheles stephensi*, and to a lesser extent *A. culicifacies* (Rowland et al 2000, Rowland et al 1997). All age groups up to 30 years appear to be equally at risk of developing malaria; evidence for the lack of development of functional immunity in the population (Suleman, 1988, unpublished observations).

Map: Estimated geographical distribution of malaria in Afghanistan:

Malaria treatment is now entering a period of change. The MoPH, on the advice of WHO and HNI, has endorsed the policy of using artesunate combination therapy (ACT) as first line treatment for *falciparum* malaria following a trial of a variety of combinations of drugs. The most promising candidate, with 100% efficacy over 42 days of follow-up was the combination of SP with artesunate (AS) (Graham et al, in press). Chloroquine therapy remains highly effective against the acute stage of vivax malaria (unpublished obs). Primaquine therapy for radical cure of vivax malaria
remains problematic due to the prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in the population. Diagnosis of malaria still chiefly relies on field microscopy.


Mother and Child Health in Afghanistan:

Afghanistan has one of the worst maternal and child mortality rates in the world - estimated at 20% of under 5s and 16/1000 pregnancy related deaths (UNICEF 2005). An estimated half of Afghan children are malnourished (UNICEF 2005). A recent report by UNICEF and CDC (Bartlett et al, 2005) estimated that 87% of maternal deaths were considered preventable. Female literacy is also one of the lowest rates in the world, especially in rural areas - recent estimates place the illiteracy rate at around 85% of females, with females still being half as likely to be enrolled in school as males. Therefore, improvement of mother and child health is a key component of Afghanistan’s health care rehabilitation. The Safe Motherhood Initiative forms one of the components of this programme. Until recently MCH had been implemented by a variety of NGOs and private practitioners, but currently this component is being integrated into general health services as part of the Basic Package of Health Services (BPHS). There is a lack of local knowledge of the scale and scope of malaria's contribution to the spectrum of mother and child morbidities and mortalities effecting Afghanistan.

The effects of malaria in pregnancy:

The effects of malaria due to *Plasmodium falciparum* in pregnancy have been well established. Malaria parasites are known to sequester in highly vascularised tissue (i.e. the brain, lungs), including the placenta. The mechanism of sequestration in placentae is well documented (Fievet et al 2002). The effect of this sequestration is to hinder the transmission of nutrients and other vital components of placental function through restricted blood flow. This leads to poor development of placenta, and the effects on the foetus are retarded growth, leading to low birth weight, poor birth outcome and poor development in early life. Low birth weight is associated with higher rates of mortality in the first 5 years of life, as well as further known deleterious effects in later life. In the worst
cases pregnancies do not reach term and the effect on the mother can be equally profound. These effects are particularly important in primigravidae, who are more likely to suffer poor birth outcomes, still birth, and death.

The majority of studies on malaria in pregnancy originate from Africa which is characterised by hyper-endemicity of predominantly falciparum malaria; there is a general lack of knowledge on malaria in pregnancy from central Asia, and even fewer published works on the effect of vivax malaria in pregnancy. One published paper (Nosten et al 1999) demonstrated that *P. vivax* in pregnancy was associated with maternal anaemia and low birthweight in Karen refugees in Thailand. The effect on anaemia was more profound in primigravidae, and vivax malaria was more common in this group than in multigravidae. Vivax malaria was not associated with miscarriage, stillbirth or shortened duration of pregnancy. There is no quantative, reliable data on the epidemiology, effects and KAP amongst pregnant women in Afghanistan.

**Objectives**

The primary goal of this study is to accurately estimate the prevalence of malaria among pregnant women in selected districts of Nangarhar Province, Afghanistan, and its association with maternal anaemia and other morbidities in order to develop appropriate intervention measures.

The objectives of the study are to:

Estimate the prevalence of malaria in pregnant women.

Assess perceptions of ANC usage and malaria as a problem associated with pregnancy.

Assess the prevalence of maternal anaemia and its correlation with maternal malaria prevalence.

Assess the proportion of low birth weight babies attributable to malaria.

Identify alternative causes of maternal anaemia as potential confounders.

The aim of the project is to use the information to design and pilot a programme of appropriate interventions for reducing mortality and morbidity due to malaria in pregnancy in Afghanistan.

**Methods:**

In order to achieve the objectives above 3 separate studies were undertaken.

A cross sectional prevalence and KAP survey in pregnant and non-pregnant women in villages in Nangahar and Laghman Provinces.

A delivery room survey in Ghani Kiel Hospital, Nangahar, a secondary level district hospital.

A case control survey of women of child bearing age in clinics in Nangahar and Laghman.
An additional survey was conducted at the same time as survey 2, to assess the effectiveness of WHO colour charts designed to measure haemoglobin in a field setting.

The methods of each survey are described separately below:

**Cross sectional prevalence and KAP survey:**

**Study area and population:**

The study population comprised of pregnant women in Shinwar, Mohmand Dara, Batikot, and Nazian districts. These districts have comparatively well functioning community health facilities including ANC services. In addition a sub-sample of non-pregnant women from the general population of child bearing age had haemoglobin measured for comparison.

**Questionnaire Study:**

Data on malaria-related perceptions and practices was gathered from ~500 pregnant women using a structured questionnaire. Trained temporary female interviewers collected data using a standardised and validated questionnaire. Two survey's were conducted; the first took place in May and June 2004, and the second in December 2004. This was designed to incorporate the peak of the transmission seasons for both vivax and falciparum malaria.

The questionnaire was designed to establish knowledge attitudes and practices towards a range of factors effecting pregnancy. Data on socioeconomic status, practices during pregnancy and knowledge and practices associated with malaria were collected. The questionnaire is appended (Annex 1).

**Malaria and Anaemia Prevalence Study:**

The malaria prevalence study coincided with the questionnaire study; all women who are interviewed were asked to give verbal consent to have thick and thin blood films taken. Slides were examined the same day by a trained microscopist under oil immersion at 100x magnification. 200 fields were examined before a slide was declared negative. Slides were re-read at a later date by an experienced microscopist who was blind to the original diagnosis. Participants found to be positive were referred to the nearest clinic for treatment. Haemoglobin was measured using a HemoCue photometric test - if found to be anaemic they were advised to take folate and iron supplements. In addition, age of gestation and number of previous pregnancies were recorded. Haemoglobin was also measured in a random sample of non-pregnant women in the same villages as the pregnancy survey was conducted in.

**Sampling:**

Villages for the survey were selected on the basis of malaria prevalence, and availability of ANC services. In addition security concerns were taken into consideration, and access to females at each site. Prior to each village being surveyed the elders / community leaders of each village were contacted and the purposes and processes of the study were explained to them. It was felt important to ‘sensitise’ these
individuals to the survey, and their assent was considered essential to the sampling strategy. On the day(s) of the survey all pregnant women were asked to attend the survey.

**Delivery Room Survey:**

Study Population and Sample collection: Those who gave birth in the delivery ward of the Ghani Kheil Hospital were included in the survey. Informed consent was given and the following samples were collected for analysis:

- **Stool sample:** to provide data on prevalence of worm infestations, a common cause of maternal anaemia.
- **Thick and thin blood films of cord and placental blood.**
- **Placental biopsy:** a punch biopsy was taken in order to examine for presence of sequestered malaria parasites, or evidence of previous malaria infection.
- **Placental and neonatal weight.**
- **Haemoglobin.**

**Case Control Survey:**

In order to assess whether pregnancy is a risk factor for malaria in Eastern Afghanistan, a survey was established at eight health centres in Nangahar and Laghman provinces. Data were collected from all female patients of child bearing age presenting at the out patients departments of the selected sites. Sites were selected on the basis of known malaria endemicity, availability of malaria diagnostic facilities, and the centre’s willingness to participate in the study.

Data were collected between September 2004 and January 2005 using standardised data collection forms. Each patient was examined by the clinic doctor and diagnoses were noted on a case reporting form along with age, marital status, number of children and number of previous pregnancies.

A case was defined as any patient presenting with symptoms which lead the physician to suspect malaria which was confirmed by microscopy (thick and thin smears). Controls were defined as patients presenting with symptoms of malaria who would routinely have a blood slide taken but with a negative smear on examination of thick and thin films. Further, patients were defined as either vivax or falciparum positive. Slides were blindly cross checked by an experienced microscopist. All patients found to be positive were treated appropriately.

**Additional Assessment:**

In addition to the above surveys, at the request of WHO, colour charts for assessing haemoglobin concentrations were compared with conventional measurement using an electrophotometer (HemoCue). Haemoglobin was measured in each woman using both methods of evaluation with the measurement being done blindly. Measurements were recorded on each individual record and compared.
Comparison is presented to give a numeric comparison of haemoglobin and the prediction of anaemia (classified as Hb<11).

**Data collection and analysis:**

All data was collected on standardised forms and inputted using MS Access. Following data input, results were analysed using MS Excel and STATA 6.

**Results**

Cross sectional prevalence and KAP survey:

Baseline Data and Socioeconomic makeup of survey population:

A total of 530 women who were pregnant were included in the survey. Baseline data are presented in table 1:

<table>
<thead>
<tr>
<th>Table 1: Baseline data for women included in the questionnaire survey.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number enrolled</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
</tr>
<tr>
<td>15-20</td>
</tr>
<tr>
<td>21-25</td>
</tr>
<tr>
<td>26-30</td>
</tr>
<tr>
<td>&gt;30</td>
</tr>
<tr>
<td><strong>Education</strong></td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Religious/informal</td>
</tr>
<tr>
<td>Primary</td>
</tr>
<tr>
<td>Middle</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>University/Technical</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
</tr>
<tr>
<td>Number of people in household: Mean (SD), Range</td>
</tr>
<tr>
<td>9.8 (5.7) 1-39</td>
</tr>
<tr>
<td>Number of children under 5 years: Mean (SD), Range</td>
</tr>
<tr>
<td>2.6 (2.3) 0-18</td>
</tr>
<tr>
<td>Number of rooms per house: Mean (SD), Range</td>
</tr>
<tr>
<td>3.0 (1.6) 1-12</td>
</tr>
<tr>
<td>HH owns land</td>
</tr>
<tr>
<td>Mean No. of Jerebs (SD), Range</td>
</tr>
<tr>
<td>1.51 (1.16) 1-8</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
</tr>
<tr>
<td><strong>Water Source</strong></td>
</tr>
<tr>
<td>Stream</td>
</tr>
<tr>
<td>Well</td>
</tr>
<tr>
<td>Piped</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Household Assets</strong></td>
</tr>
<tr>
<td>Bicycle</td>
</tr>
<tr>
<td>Car/Truck</td>
</tr>
<tr>
<td>Cassette Player</td>
</tr>
<tr>
<td>Rugs</td>
</tr>
<tr>
<td>Curtains</td>
</tr>
<tr>
<td>Pressure cooker</td>
</tr>
<tr>
<td>ITN</td>
</tr>
</tbody>
</table>

Mean age at the time of the survey was 28.2 years (SD=6.1), and the vast majority had had no formal education (80%), with the majority of the remainder having only informal/religious schooling (10%). 10%
reported having received any formal education.

Socioeconomic quartiles were set using the information on education, housing and household assets. This data was analysed using principle components analysis (PCA), using household asset variables to weight individual participant’s household assets into the quartiles. Household assets used for PCA are shown in table 2.

### Table 2: Factors used to define socioeconomic quartiles using PCA.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Socio-economic Quartile (SEQ)</th>
<th>[n (%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has No education</td>
<td>Poorest 1</td>
<td>133 (100)</td>
</tr>
<tr>
<td>Has Religious/informal education</td>
<td>2</td>
<td>8 (6.1)</td>
</tr>
<tr>
<td>Has Primary education</td>
<td></td>
<td>0 (0)</td>
</tr>
<tr>
<td>Has Secondary education</td>
<td></td>
<td>0 (0)</td>
</tr>
<tr>
<td>Has &gt;Secondary Education</td>
<td></td>
<td>0 (0)</td>
</tr>
<tr>
<td>Water Source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gets Water from Stream</td>
<td></td>
<td>21 (15.8)</td>
</tr>
<tr>
<td>Gets Water from Well</td>
<td></td>
<td>82 (61.7)</td>
</tr>
<tr>
<td>Gets Water from Pipe</td>
<td></td>
<td>18 (13.5)</td>
</tr>
<tr>
<td>Missing Data</td>
<td></td>
<td>12 (9.0)</td>
</tr>
<tr>
<td>Head of Household’s employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td></td>
<td>3 (2.3)</td>
</tr>
<tr>
<td>Farmer</td>
<td></td>
<td>30 (22.6)</td>
</tr>
<tr>
<td>Labourer</td>
<td></td>
<td>72 (54.1)</td>
</tr>
<tr>
<td>Shop/Market stall</td>
<td></td>
<td>16 (12.0)</td>
</tr>
<tr>
<td>Driver</td>
<td></td>
<td>7 (5.3)</td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Missing Data</td>
<td></td>
<td>3 (2.2)</td>
</tr>
<tr>
<td>Household Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has Guest Room</td>
<td></td>
<td>38 (28.6)</td>
</tr>
<tr>
<td>Owns Land</td>
<td></td>
<td>30 (22.6)</td>
</tr>
<tr>
<td>Owns Bike</td>
<td></td>
<td>29 (21.8)</td>
</tr>
<tr>
<td>Owns Car</td>
<td></td>
<td>1 (0.8)</td>
</tr>
<tr>
<td>Owns Cassette Player</td>
<td></td>
<td>1 (0.8)</td>
</tr>
<tr>
<td>Owns Rug</td>
<td></td>
<td>6 (4.5)</td>
</tr>
<tr>
<td>Owns Curtains</td>
<td></td>
<td>6 (4.5)</td>
</tr>
<tr>
<td>Owns Pressure Cooker</td>
<td></td>
<td>17 (12.8)</td>
</tr>
<tr>
<td>Owns ITN</td>
<td></td>
<td>6 (4.5)</td>
</tr>
</tbody>
</table>

**Results of Questionnaire Survey:**

**General Health and Health Seeking Behaviour:**

The majority of those interviewed (85%) identified malaria to be a major concern, identifying the disease as the “worst health problem” faced by the community. By contrast only 6% identified each of diarrhoea and acute respiratory tract infections as the major health problems. This result was the same for all age groups and socioeconomic quartiles. There are two possible explanations for this. It is most likely that the health education campaigns implemented over the years of operations have created the perception that malaria is a major health problem. The second explanation may be that the respondents were aware that the principle focus of the
survey was malaria, and thus were presensitised.

Vaccine coverage appeared to be high; 96% of respondents reported that all of the children in their household had completed their EPI vaccines, and 82% of women reported having received the tetanus toxoid vaccine.

78% reported that government clinics (i.e. general health services provided by NGOs) were the primary source of health care provision. This figure did not differ significantly by SEQ ($\chi^2=17.9$ $p=0.1$), or age group ($\chi^2=12.1$ $p=0.4$). This result stands in contrast to the findings of other surveys; a 2005 survey conducted by HNI HCSP found that 79% of respondents reported use of the private sector as the primary source. However, this difference is most likely explained by the availability of government health services in the villages surveyed for the malaria in pregnancy survey. The figure of 79% private sector use found by Soeters et al is probably more applicable to the general population since the sampling methodology was different.

The decision to send a child for treatment in times of sickness is taken, in the majority of cases, by the child’s father rather than the mother (68% vs 25%). This differs significantly on stratification by SEQ, with mothers in the highest SEQ more likely to take the decision (33% vs 22%).

### Pregnancy Variables:

The mean number of children in each family was 3.6 (SD=2.61, range=0.13). Predictably, this differed by age with older age groups having a higher mean number of children. There was no significant difference in mean number of children by SEQ. Only 27% reported that they take either iron or folate supplements during pregnancy with 55% reporting using no supplements to their diets. 0.6% reported taking malaria chemoprophylaxis. 43% reported avoiding all medicines during pregnancy with the key belief being that drugs will cause sickness if taken (51% of those who avoid all medicines), while 32% believed the practice to be dangerous.

In total, 83% reported using antenatal clinics (ANC) at least once during pregnancy, with no significant difference detected when stratified by age and SEQ. This high rate of usage is more likely to be because of the sampling area, where ANC services are available, rather than a reflection of the situation in the general population. The high rate of reported ANC use demonstrates that when services are available, they are well attended. The use of ANC services is dependent, often, on the permission of the attendees husband

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primary source of advice during pregnancy. Other sources of advice were reported as traditional birth attendant (TBA) (16%), female relatives (12%), and midwife (3%). The low use of midwives for advice presumably reflects the low level of community midwifery available in the study area, the unawareness of the population that midwifery services are available (community midwifery in the study area is a new concept), and possibly the cost of employing a trained midwife for consultation. Among those who did not use ANC services (n=71), 47% reported that it was too difficult to travel, 16% reported that their husband would not allow it and 14% reported that ANC services were not useful.

Table 3 shows preferences for location of delivery. Of interest is that older women are less likely to deliver in hospitals, and that those in the highest SEQ are more likely to deliver in hospital. The principle reason for choosing each location was reported to be for comfort, rather than availability of emergency services.

<table>
<thead>
<tr>
<th>Table 3: Probable location of delivery:</th>
<th>Age Group % (n)</th>
<th>SEQ % (n)</th>
<th>Chi</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>15-20</td>
<td>21-25</td>
<td>26-30</td>
</tr>
<tr>
<td>Home</td>
<td>58.7 (311)</td>
<td>44.0 (44)</td>
<td>60.7 (74)</td>
<td>58.2 (106)</td>
</tr>
<tr>
<td>Midwife’s Home</td>
<td>3.0 (16)</td>
<td>6.0 (6)</td>
<td>4.1 (5)</td>
<td>1.7 (3)</td>
</tr>
<tr>
<td>Hospital/Clinic</td>
<td>37.0 (196)</td>
<td>49.0 (49)</td>
<td>32.8 (40)</td>
<td>38.5 (70)</td>
</tr>
</tbody>
</table>

Doctors, TBAs, and female relatives are equally the choice of assistant at the birth, which does not differ between age group. However, those in the least poor SEQ are more likely to use a doctor at the birth, and those in the poorest SEQ are more likely to use a female relative for assistance (Chi^2=34.8 p=0.003). The principle reason for choosing a female relative is for comfort, and the principle reason for use of doctors is that help is available for emergencies.

Malaria Variables:

Over 90% of respondents reported that malaria was very common, with 38% (n=200) reporting that they had had malaria during the present pregnancy. This result is unlikely to be reflective of the true situation, since no follow-up questions were given to establish by what method their "malaria" was diagnosed, or what treatments were given.

Knowledge of malaria transmission, diagnosis, symptoms and prevention was
high; 99% reported correctly that fever, shivering/chills, headache, weakness or joint pain were symptoms of malaria; 70% reported that a blood test is used for diagnosis; 97% reported that mosquito bites transmit malaria; and 81% reported that use of an ITN was the best preventative measure. As a validation of the finding that MoH/NGO facilities are predominantly used for healthcare, 78% reported use of these facilities specifically for treating malaria.

**Use of Preventive Measures:**

66% of respondents agreed that it was necessary to take special precautions against malaria during pregnancy. Significantly fewer of the lowest SEQ thought it was necessary to take special precautions compared to the highest SEQ (60% vs 76%, Chi$^2$=9.2, p=0.03), which was a significant trend across all four groups. However 46% reported taking no precautionary measures against disease. 58% reported actual use of an ITN for malaria prevention, and there was increased ownership and use of ITNs with increasing socioeconomic status. This reflects the level of ITN ownership, however, only 38% reported ownership of ITNs in the household. There were a higher proportion of ITN owners in the highest SEQ than the lowest (4% vs 84%, Table 2).

82% of respondents reported that they would never take drugs to prevent malaria during their pregnancy. This differs significantly by SEQ (lowest - 93% vs highest – 76%, Chi$^2$=32.8, p<0.001). The majority responded that the use of drugs during pregnancy was dangerous.

**ITN Variables:**

Amongst those whose household owns an ITN, 33% and 32% reported that everybody or specifically, children usually sleep under the ITN respectively. However, when asked whether they had used an ITN last night, only 26% reported that they had. Most said that they had not because they were not bothered by insects, or that someone else was using it. Of interest is that during the first survey (in May-June) the use of ITNs last night was higher than during the second survey with borderline significance (21/76 (28%) vs 18/111 (16%), chi$^2$ p=0.059)

63% reported that the advantage of sleeping under an ITN was not being bothered by mosquitoes, and 20% reported that use was to prevent insect bites. Although the knowledge that ITNs prevent malaria is evident in this study group, only 17% reported this as the major advantage of using an ITN.

Amongst those households who do not own an ITN, 95% reported that this was because ITNs are too expensive, 4% reported that they were not available. None reported that ITNs were either uncomfortable, or not useful.
**Malariometric and Clinical Data:**

During the cross-sectional survey, point prevalence of malaria was 3.9/1000 (95% CI: 0.98-15.8 per 1000). Point prevalence of anaemia was 383/1000 (95% CI: 317-464 per 1000). Point prevalence of severe anaemia (Hb<7 g/dl) was 34/1000 (95% CI 18-49 per 1000). There were too few cases of malaria detected during this survey to perform further analysis on the effects of malaria on maternal haemoglobin concentration. However, detailed analysis of factors associated with anaemia was possible and is presented in Table 4. Adjusted odds ratios (AOR) are presented following multivariate logistic regression analysis, with each AOR adjusted for all other factors presented in the table. In addition crude odds ratios (OR) calculated using univariate analysis, mean haemoglobin, and number of cases of anaemia are presented.

There was a significant difference in mean Hb between age groups, with older women having a lower Hb concentration, and higher likelihood of being anaemic (AOR 3.1 (95% CI: 1.2-7.7)). Those in the 3rd trimester of pregnancy had a significantly lower mean Hb than those in the second trimester (10.7 vs 11.3, t-test p =<0.05). On univariate analysis the odds of anaemia was also higher in this group (OR: 1.5 (95% CI: 1.0-2.2)), although the association lost significance on multivariate analysis.

There were no further significant differences in odds of anaemia, or mean haemoglobin concentration between groups. Pregnancy itself was strongly associated with haemoglobin concentration, and odds of anaemia (Table 5) when results were compared between pregnant and non-pregnant women. The sample of non-pregnant women was selected from the general population of child bearing age.

### Table 4: Factors associated with maternal anaemia in pregnant women.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Hb (SD)</th>
<th>Anaemia [n(%)]</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
<th>P value of AOR.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-20</td>
<td>11.4 (1.9)*</td>
<td>22 (22.0)</td>
<td>78 (78.0)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21-25</td>
<td>11.0 (1.6)</td>
<td>34 (27.9)</td>
<td>88 (72.1)</td>
<td>1.4 (0.7-2.5)</td>
<td>1.7 (0.8-3.9)</td>
</tr>
<tr>
<td>26-30</td>
<td>11.0 (1.7)</td>
<td>47 (25.8)</td>
<td>135 (74.2)</td>
<td>1.2 (0.7-2.0)</td>
<td>1.6 (0.7-3.5)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>10.7 (1.7)</td>
<td>44 (34.9)</td>
<td>82 (65.1)</td>
<td>1.9 (1.0-3.4)*</td>
<td>3.1 (1.2-7.7)</td>
</tr>
<tr>
<td><strong>SEQ</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorest (1)</td>
<td>10.9 (1.8)**</td>
<td>39 (29.3)</td>
<td>94 (70.7)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>11.0 (1.7)</td>
<td>34 (25.8)</td>
<td>98 (74.2)</td>
<td>0.8 (0.5-1.4)</td>
<td>1.8 (0.8-4.5)</td>
</tr>
<tr>
<td>3</td>
<td>10.9 (1.6)</td>
<td>41 (30.8)</td>
<td>92 (69.2)</td>
<td>1.1 (0.6-1.8)</td>
<td>2.3 (0.9-5.5)</td>
</tr>
<tr>
<td>Least Poor (2)</td>
<td>11.1 (1.8)</td>
<td>33 (25.0)</td>
<td>99 (75.0)</td>
<td>0.8 (0.5-1.4)</td>
<td>1.5 (0.5-3.9)</td>
</tr>
<tr>
<td><strong>Gravidity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primi</td>
<td>11.3 (1.8)**</td>
<td>17 (23.9)</td>
<td>54 (76.1)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2-3</td>
<td>11.0 (1.8)</td>
<td>38 (27.5)</td>
<td>100 (72.5)</td>
<td>1.2 (0.6-2.3)</td>
<td>0.9 (0.4-2.1)</td>
</tr>
<tr>
<td>3-4</td>
<td>10.9 (1.7)</td>
<td>43 (29.7)</td>
<td>102 (70.3)</td>
<td>1.3 (0.7-2.6)</td>
<td>1.1 (0.5-2.6)</td>
</tr>
<tr>
<td>&gt;4</td>
<td>11.0 (1.7)</td>
<td>49 (27.8)</td>
<td>127 (72.2)</td>
<td>1.2 (0.7-2.3)</td>
<td>0.7 (0.3-1.7)</td>
</tr>
<tr>
<td><strong>Trimester</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10.9 (2.1)*</td>
<td>3 (33.3)</td>
<td>6 (66.6)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>11.3 (1.7)*</td>
<td>57 (23.3)</td>
<td>188 (76.7)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>10.7 (1.7)</td>
<td>87 (31.5)</td>
<td>189 (68.5)</td>
<td>1.5 (1.0-2.2)*</td>
<td>1.4 (0.9-2.3)</td>
</tr>
<tr>
<td><strong>ANC Use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Associations of pregnancy with anaemia.

<table>
<thead>
<tr>
<th>Pregnant</th>
<th>Mean Hb (SD)</th>
<th>Anaemia [n(%)]</th>
<th>Crude OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12.1 (1.7)**</td>
<td>101 (21.3)</td>
<td>1.4 (1.1-1.9)**</td>
</tr>
<tr>
<td>Y</td>
<td>11.0 (1.7)</td>
<td>147 (27.7)</td>
<td>1.4 (1.1-1.9)**</td>
</tr>
</tbody>
</table>

* ANOVA, p<0.05 ** ANOVA, NS. ** T-test, NS * p<0.05 - univariate logistic regression t T-test: trimester 2 vs trimester 3 (t=3.7, p=0.0002.)

Delivery Room Survey:

A total of 518 women agreed to take part in the study between February and December 2004. Baseline data is presented below in table 6:

Table 6: Baseline data for Delivery room survey.

| N | Age - mean (SD) | 518 | 25.2 (5.8) |
|   | Age Group - n (%) |     |           |
|   | 15-20 | 208 (40.8) |
|   | 21-25 | 106 (20.8) |
|   | 26-30 | 126 (24.7) |
|   | >30   | 70 (13.7)  |
|   | Missing data | 8 (1.5)  |
|   | Mean Birth Weight (SD) /Kg | 3.2 (0.5) |
|   | Mean Hb (g/dl) | 11.6 (1.8) |

In this sample the prevalence of anaemia was 346/1000 (95% CI: 305-388/1000), which is comparable to the prevalence found in the cross sectional survey - 383/1000 (95% CI: 317-464 per 1000) (see 3.2.1.6, above). The point prevalence of low birth weight in this group (defined as weight at birth <2.5kg) was 107/1000 (95% CI: 80-134/1000). There were no cases of malaria detected in this group at the time of birth. Presence of anaemia was not associated with any of presence of intestinal parasites, age, or gravidity on univariate or multivariate logistic regression. However, low birth weight was associated with age and gravidity on univariate analysis and with gravidity on multivariate analysis (Table 7).
Table 7: Associations of various factors with maternal anaemia at term and low birth weight.

**Associations with Anaemia:**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Y</th>
<th>N</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20</td>
<td>66</td>
<td>141</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21-25</td>
<td>36</td>
<td>70</td>
<td>1.10 (0.67-1.81)</td>
<td>1.05 (0.62-1.79)</td>
</tr>
<tr>
<td>26-30</td>
<td>46</td>
<td>80</td>
<td>1.23 (0.77-1.96)</td>
<td>1.13 (0.61-2.12)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>29</td>
<td>41</td>
<td>1.51 (0.86-2.64)</td>
<td>1.26 (0.58-2.72)</td>
</tr>
</tbody>
</table>

**Gravidity**

<table>
<thead>
<tr>
<th>Primigravidae</th>
<th>Y</th>
<th>N</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>49</td>
<td>76</td>
<td>1.50 (0.93-1.81)</td>
<td>1.41 (0.85-2.37)</td>
</tr>
<tr>
<td>3-5</td>
<td>8</td>
<td>25</td>
<td>0.75 (0.32-1.76)</td>
<td>0.67 (0.22-1.72)</td>
</tr>
<tr>
<td>&gt;5</td>
<td>66</td>
<td>104</td>
<td>1.48 (0.95-2.31)</td>
<td>1.29 (0.67-2.50)</td>
</tr>
</tbody>
</table>

**Intestinal Parasites**

<table>
<thead>
<tr>
<th>N</th>
<th>Y</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>166</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>27</td>
<td>0.83 (0.41-1.68)</td>
<td>0.79 (0.38-1.60)</td>
</tr>
</tbody>
</table>

**Associations with Low Birth Weight**

<table>
<thead>
<tr>
<th>Low Birth Weight</th>
<th>Y</th>
<th>N</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaemia</td>
<td>37</td>
<td>291</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
<td>157</td>
<td>0.80 (0.43-1.48)</td>
<td>0.92 (0.48-1.75)</td>
</tr>
<tr>
<td>15-20</td>
<td>33</td>
<td>172</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21-25</td>
<td>9</td>
<td>92</td>
<td>0.51 (0.23-1.11)</td>
<td>0.78 (0.34-1.78)</td>
</tr>
<tr>
<td>26-30</td>
<td>7</td>
<td>116</td>
<td>0.31 (0.13-0.73) *</td>
<td>0.99 (0.31-3.11)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>4</td>
<td>65</td>
<td>0.32 (0.11-0.94) *</td>
<td>2.02 (0.41-10.1)</td>
</tr>
</tbody>
</table>

**Gravidity**

<table>
<thead>
<tr>
<th>Primigravidae</th>
<th>Y</th>
<th>N</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>9</td>
<td>113</td>
<td>0.32 (0.15-0.69) *</td>
<td>0.33 (0.14-0.75) *</td>
</tr>
<tr>
<td>3-5</td>
<td>2</td>
<td>31</td>
<td>0.26 (0.06-1.12)</td>
<td>0.24 (0.05-1.26)</td>
</tr>
<tr>
<td>&gt;5</td>
<td>6</td>
<td>163</td>
<td>0.15 (0.06-0.36) *</td>
<td>0.10 (0.03-0.42) *</td>
</tr>
</tbody>
</table>

**Intestinal Parasites**

<table>
<thead>
<tr>
<th>N</th>
<th>Y</th>
<th>OR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>4</td>
<td>0.95 (0.32-2.79)</td>
<td>1.11 (0.36-3.44)</td>
</tr>
</tbody>
</table>

* P<0.05

**Case Control Study:**

Baseline data for the case control study can be seen in Table 8. In total 1212 women of child bearing age were enrolled in the study from eight health facilities in Nangahar and Laghman provinces.

Table 8: Baseline data collected for case control study:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1212</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>28.9 (10.0)</td>
</tr>
<tr>
<td>n pregnant (%)</td>
<td>284/1209 (23.5)</td>
</tr>
<tr>
<td>Mean number of children (SD)</td>
<td>4.8 (2.5)</td>
</tr>
<tr>
<td>Number reporting ITN use (%)</td>
<td>496/1212 (40.9)</td>
</tr>
</tbody>
</table>
23.5% of women enrolled were pregnant and a total of 143 had microscopically confirmed malaria. 29.9% of malaria cases were due to Pf, this reflecting the seasonal nature of both species of malaria; this survey was conducted between October and December 2004, at the peak of the falciparum season.

Prevalence of malaria (both Pv and Pf combined) were compared between exposures to factors listed in table 9.

Table 9: Factors effecting malaria in a variety of risk factors.

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Exposure: [n cases/n controls (%)]</th>
<th>Crude OR (95% CI) [p]</th>
<th>AOR (95% CI) [p]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITN Use</td>
<td>46/450 (10.2)</td>
<td>0.65 (0.45-0.94) [0.02]</td>
<td>0.48 (0.30-0.75) [0.01]</td>
</tr>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-20</td>
<td>32/286 (11.2)</td>
<td>0.79 (0.52-1.20) [0.3]</td>
<td>1</td>
</tr>
<tr>
<td>21-25</td>
<td>18/179 (10.0)</td>
<td>0.71 (0.43-1.20) [0.2]</td>
<td>1.51 (0.60-4.11) [0.4]</td>
</tr>
<tr>
<td>26-30</td>
<td>44/258 (17.1)</td>
<td>1.40 (0.95-2.0) [0.09]</td>
<td>2.92 (1.14-7.48) [0.03]</td>
</tr>
<tr>
<td>31-40</td>
<td>34/238 (14.3)</td>
<td>1.10 (0.72-1.64) [0.7]</td>
<td>2.49 (0.93-6.71) [0.07]</td>
</tr>
<tr>
<td>&gt;40</td>
<td>13/92 (14.1)</td>
<td>1.10 (0.58-1.93) [0.8]</td>
<td>2.93 (0.76-7.47) [0.13]</td>
</tr>
<tr>
<td>Pregnant</td>
<td>31/253 (12.0)</td>
<td>0.89 (0.58-1.35) [0.6]</td>
<td>0.92 (0.57-1.49) [0.7]</td>
</tr>
<tr>
<td>Gravidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8/72 (11.1)</td>
<td>0.81 (0.39-1.71) [0.6]</td>
<td>1</td>
</tr>
<tr>
<td>1-3</td>
<td>24/156 (15.4)</td>
<td>1.18 (0.73-1.92) [0.5]</td>
<td>1.16 (0.48-2.77) [0.7]</td>
</tr>
<tr>
<td>&gt;4</td>
<td>74/560 (13.2)</td>
<td>0.94 (0.61-1.46) [0.8]</td>
<td>0.77 (0.32-1.79) [0.5]</td>
</tr>
</tbody>
</table>

ITN use is demonstrated to be protective against malaria (AOR = 0.48, 95% CI 0.3-0.75). There were no other significant associations between exposures and disease in this study group on univariate analysis. However, on multivariate logistic regression analysis, those in the age-group 26-30 were more at risk of disease than other ages. Neither pregnancy, nor gravidity was associated with increased odds of malaria compared to unexposed groups.

The study group for this assessment was the same as in the delivery room survey. A total of 518 women were examined. Baseline data can be seen in Table 6, above.

Although the population prevalence of anaemia (defined as <11 g/dl) detected by the two measurement methods was similar, there appear to be differences on quantitative analysis; there was a significant difference between the mean haemoglobin as measured by the HemoCue hemoglobinometer, and the WHO colour strips (Table 10).
Table 10: Results from field test of WHO haemoglobin colour charts.

<table>
<thead>
<tr>
<th></th>
<th>WHO Colour</th>
<th>HemoCue</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Hb (SD)</td>
<td>11.4 (2.1)</td>
<td>11.6 (1.8)</td>
<td>Ttest, p=0.03</td>
</tr>
<tr>
<td>n (%) Anaemic</td>
<td>191 (37.8)</td>
<td>174 (34.3)</td>
<td>Chi=1.2 p=0.36</td>
</tr>
<tr>
<td>Tests of Accuracy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>False Positives [n(%)]</td>
<td>82 (16.2)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>False Negatives [n(%)]</td>
<td>65 (12.9)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>37%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Specificity</td>
<td>75%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>PPV*</td>
<td>57%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>NPV*</td>
<td>79%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Mean Hb when HemoCue reads (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-10.9</td>
<td>10.5 (1.3)</td>
<td>9.7 (1.0)</td>
<td>Ttest, p&lt;0.001</td>
</tr>
<tr>
<td>11-12.9</td>
<td>11.6 (2.6)</td>
<td>11.9 (0.6)</td>
<td>Ttest, p=0.07</td>
</tr>
<tr>
<td>&gt;13</td>
<td>12.3 (1.2)</td>
<td>14.0 (1.0)</td>
<td>Ttest, p&lt;0.001</td>
</tr>
</tbody>
</table>

*PPV-Positive predictive value, NPV-Negative predictive value.

The WHO test strips showed a low sensitivity, and a reasonably high specificity, however, this is unlikely to be of use in field settings.

When quantitative results are compared, stratified by Hb concentration measured with the HemoCue, there are significant differences. For example, the mean of all values between 6-9.9 measured by the HemoCue machine is 9.7 (SD=1.0). The mean of the values measured in the same group by the WHO colour strips is 10.5 (SD=1.3), showing a significant difference using the students t-test (p>0.001). In the range from 11-12.9, the results are comparable, but again in higher Hb concentrations the results differ, with the WHO strips underestimating the concentrations.

Discussion and Recommendations:

The major problem associated with this survey is the lack of malaria patients identified during the cross sectional and delivery room survey. Despite use of accepted cross sectional prevalence survey methods, a prevalence of only 3.6/1000 was found amongst pregnant women, and zero cases detected at birth in the delivery room survey. This reflects a genuine reduction in malaria transmission rates seen across Afghanistan and Western Pakistan in the last 2-3 years. The reasons for this reduction may be the effect of enhanced malaria control activities or reflect changing environments (for example, change in land use, climatic factors). It is likely that the estimate is an under estimation of the true prevalence since some selection bias may have produced fewer cases presenting at the time of the survey. This shortage of cases has made thorough assessment of the effects of malaria on maternal anaemia and
birth outcome impossible. However, information obtained during the KAP and case control surveys do provide some insight into perceptions, practices and risk factors. In addition, 38% of those interviewed in the KAP survey reported having malaria during their pregnancy – although an inaccurate measure.

The results of this study also provide a view of maternal anaemia, which seems to be affected mostly by factors not measured in this survey. It is most likely that a generally poor diet, lack of access to nutritional supplements during pregnancy, lack of birth spacing, and high frequency of pregnancy are the reasons for this. A nutritional survey of females, particularly in pregnancy is warranted.

**KAP and Cross sectional survey:**

Despite very low levels of female education, knowledge of malaria is high. This reflects successful public health education campaigns and shows that these can be effective in groups with high levels of illiteracy. It should be remembered that this geographical area is one where HNI has been very active for a decade. In other, more inaccessible areas it is likely that knowledge will be lower. Nevertheless, this survey shows that a sustained and long running public education program can achieve excellent results. A potential source of bias could be related to those with access to public health information are also more likely to be included in the survey (for cultural reasons).

The targeting of males in education about MCH appears to be appropriate in Afghanistan. The evidence that the majority of treatment seeking decisions made by the household are made by the husband (or head of household) is evidence that males should also be the focus of such campaigns. In this cultural setting it is necessary to consider these individuals as key partners for improving the healthcare of females and children, especially amongst the poorest sectors of the community.

In terms of specific interventions against malaria, it is unlikely that intermittent presumptive treatment (IPT) would be a successful strategy. Firstly, the low prevalence of malaria in pregnancy does not warrant such an intervention, and secondly this is unlikely to be an acceptable method of malaria prevention when used as a routine policy. This strategy should not be discounted absolutely, since it has its use in epidemics and possibly in areas where high prevalence of malaria is detected in the general population during the falciparum season.

The primary preventive measure to be considered in reducing the burden of malaria in pregnancy should be the implementation of ITNs for all pregnant women. This method is acceptable to the population, and has a proven efficacy in prevention (see results of case-control
study), despite the fact that more than 80% of interviewees cited prevention of mosquito or insect bites as the primary reason for using an ITN rather than malaria prevention. These can be distributed in a variety of ways in order to increase equitable access to nets. Those who do not own a net (the majority being in the lowest SEQ) cite cost as the major barrier to access. One possible way of ensuring equitable access is to give all pregnant women a voucher at the ANC to be redeemed at ITN sales outlets. Given the present focus of ITN strategy on developing a private sector, this voucher scheme would allow increased access to this group without undermining the private sector. This scheme should be piloted as soon as possible, with high levels of monitoring to assess whether nets distributed in this way are used by the target group. There is a double advantage to using ANCs for distribution of very highly subsidised ITNs – firstly to increase access to the intervention, and secondly to increase attendance at ANCs. In areas where ANC services are sparse or unavailable, the strategy of using CHWs for distribution should be considered. For those who own an ITN, the message to continue to use it throughout the year should be enforced; during the winter months, during the falciparum season, use of ITNs were reported as being lower than in the summer.

Malirometric and Clinical Data:

The prevalence of malaria is likely to be underestimated by this sampling strategy; women with symptomatic malaria would be less likely to attend the survey since they were ill at the time, and the survey took place at a central location in each village, rather than a household based survey (the so-called healthy-worker effect). However, the prevalence of malaria was some hundred times lower than the prevalence of anaemia in the study group; a difference which cannot be attributed to selection bias alone. This suggests, again, that maternal anaemia is very much associated with factors not measured in this group. Surprisingly, there was no significant difference in odds of anaemia when stratified by use of iron and/or folate supplements. Again, this suggests that a generally poor diet is the major contributing factor to maternal anaemia, and so the use of iron and folate, while undoubtedly a proven necessity in pregnancy may be less effective against a backdrop of generally poor diet. In this survey group, those aged over 30 years were more likely to suffer anaemia than other age group possibly due to multi-parity and lack of birth spacing. In addition those in the third trimester are more likely to be anaemic than other trimesters on univariate analysis. This association is border-line significant on multivariate analysis. The risk of anaemia in the first trimester was not significant (small sample size in this group), although their mean haemoglobin was lower than the
second trimester group. Use of ANC services was not associated with risk of anaemia.

In this group, neither ITN ownership nor “ITN use last night” was associated with lower risk of anaemia. This is consistent with the idea that malaria is not a major contributor to maternal anaemia, since data from the case control survey clearly shows that ITN use prevents malaria. If it were the case that malaria was a major contributor to maternal anaemia, it would be expected that ITN use would also reduce the risk of anaemia, which is not borne out by the data presented in this study.

Pregnancy was associated with anaemia, and there was a significant difference in mean Hb between pregnant and non-pregnant women. The prevalence of anaemia in non-pregnant women was also high, with one in five being found to be anaemic, again suggesting poor diet to be the main contributor.

Delivery Room Survey:

Again, the delivery room survey lacked any malaria cases at time of birth, making analysis on the effect of malaria on either maternal anaemia at birth or low birth weight impossible. The prevalence of anaemia in this group were comparable to the prevalence found in the cross-sectional survey. None of the factors measured in this survey were independently associated with anaemia, nor associated on multivariate analysis. Again, this is suggestive of generally poor diet, and poor birth-spacing being the major contributor to maternal anaemia.

There are some associations with low birthweight, however. On univariate analysis LBW was associated with age (older age groups were less likely to produce LBW babies, although this association disappears on multivariate analysis. On univariate and multivariate analysis, primigravidae are more likely to produce LBW babies. The presence of intestinal parasites was not associated with either anaemia or LBW.

Case-Control Study:

ITN use is clearly demonstrated by this data to be protective against malaria. This is not a surprising finding, since many studies both inside and outside the region have demonstrated the efficacy of this intervention at preventing malaria. Age group is also associated with greater risk of malaria (in the age range of 26-30). However, this trend does not extend to other age groups.

Pregnancy is not significantly associated with malaria. While it is generally accepted that pregnant women are more likely to suffer from malaria than non-pregnant women, this effect has really only been explored in Africa. The differing epidemiological setting in Afghanistan provides an insight. It is most likely to be a factor of the differing levels of immunity in
this population compared to areas of hyper-endemicity; In Afghanistan, where there is low to moderate transmission, immunity is slow to develop and thus most patients will experience symptoms of disease. In areas of hyper-endemicity, where immunity provides protection from clinical disease, pregnant women are more likely to show symptoms than non-pregnant women. In the low-moderate transmission setting, such as in this region, all cases, pregnant or not, are likely to exhibit symptoms of malaria.

In any event, 12% of women who were pregnant in this survey were found to have malaria. This is not to say that the prevalence of malaria is this high. Using the case-control study design does not allow an estimate of prevalence to be made; it shows that this proportion of febrile patients presenting at clinics have malaria, and is consistent with the estimate of 10-25% slide positivity for febrile illness in the region (HNI unpublished obs.).

**General Comments and Conclusions:**

The design of this survey provides a well rounded view of malaria in pregnancy by using three separate study designs to examine the scope of the problem and its effect on maternal anaemia and low birth weight.

The main conclusion to be drawn from these surveys is that factors other than malaria are chiefly responsible for the high prevalence of maternal anaemia detected in the delivery room and cross-sectional surveys.

However, there is still an appreciable prevalence of malaria detected in the population of pregnant women surveyed, enough to warrant specific action against the disease. The most likely successful intervention would be the up-scaling and use by the community of ITNs, which are acceptable to the population, and have been demonstrated to be effective at reducing risk of malaria in users versus non-users. The implementation of IPT is unlikely to be warranted in this setting.

Efforts should be made to expand the network of ANCs across the country, since this survey provides evidence that where available, the clinics are well attended. One way to increase attendance is to use these clinics as outlets for highly subsidized (or free) ITNs.

The high prevalence of maternal anaemia and low birthweight is a serious cause for concern, but a link between these factors and malaria was not seen in this study. It is most likely that the generally poor state of diet and poor birth-spacing amongst females is the major contributing factor, and this needs to be addressed as a matter of urgency. The first way of addressing this problem is to define a baseline using a
comprehensive nutritional survey which should involve KAP survey’s as well as assessment of diet and other contributory factors. It is vital to the success of the Safe Motherhood initiative to investigate these factors fully, and to include males in any efforts to improve the nutritional status of the female population.

Recommendations:

The following recommendations are made for improving the health of females and improve birth outcomes, as well as preventing malaria.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption of countrywide education messages for malaria and malaria in pregnancy, including males in target group.</td>
<td>Good knowledge of malaria in study group, despite low levels of education. 68% of health care seeking decisions made by husbands</td>
</tr>
<tr>
<td>Increase level of use and awareness of appropriate preventive measures</td>
<td>46% report taking no precautionary measures against malaria 66% reported that it is necessary to take precautions</td>
</tr>
<tr>
<td>Adoption of ITN as main preventative strategy.</td>
<td>ITN use is associated with lower risk of disease Acceptable.</td>
</tr>
<tr>
<td>Targeted distribution of ITNs at highly subsidised prices through ANC services, especially for the very poor.</td>
<td>All SEQs report use of ANC services, where available Lowest SEQ less likely to own ITN, with expense being the barrier to purchase/use</td>
</tr>
<tr>
<td>No implementation of IPT in pregnancy, under normal conditions. Possibility of use in highly endemic areas/ during epidemics.</td>
<td>Prevalence of malaria does not warrant this intervention. 82% report that they would never take antimalarials to prevent malaria while pregnant.</td>
</tr>
<tr>
<td>Increase ITN usage in the home by pregnant women, including the winter months.</td>
<td>26% of pregnant women report use of ITN &quot;last night&quot;.</td>
</tr>
<tr>
<td>Increase awareness of importance of good diet to female health, as well as in pregnancy.</td>
<td>High prevalence of anaemia in both pregnant and non-pregnant women. Lack of association with common causes of anaemia and risk of anaemia</td>
</tr>
</tbody>
</table>

References


Transactions of the Royal Society of Tropical Medicine and Hygiene. 83; 471-473.


Insecticide Treated nets and Operational Research – Progress and Future Plans under GF Round 5

HealthNet TPO.

**Introduction:**

HealthNet TPO is involved as a co-implementer for LLIN distribution and operational research for Malaria Control Program in fourteen high malaria risk provinces – Nangarhar, Laghman, Kunar, Khost, Baghlan, Kunduz, Takhar, Badakhshan, Balkh, Faryab, Helmand, Kandahar, Heart and Badghis.

**HealthNet TPO's Malaria Control Program**

Implements malaria control activities in the fourteen provinces of the country through a project funded by GFATM -Global Fund to fight AIDS, TB and Malaria- for a period of five years (from Nov 01, 2006 to Oct 31, 2011). This is the Global Fund Round 5 Malaria Grant with program title "Strengthening and scaling up the RBM (Roll Back Malaria) efforts in Afghanistan 2006-2010". Phase 1 of the grant (first two years) was successfully implemented in 10 provinces (Nangarhar, Laghman, Kunar, Khost, Baghlan, Kunduz, Takhar, Badakhshan, Balkh and Faryab), started with 6 provinces in 2007 and expanded to 10 provinces in 2008. The project is expanded to Helmand and Kandahar in 2009 and will be expanded to Herat and Badghis in 2010. In addition to geographical expansion of the program, HealthNet TPO's role from sub-recipient in phase 1 is transformed to principal recipient in phase 2 starting from 2009 for the implementation of two major components of the grant (Mosquito nets -long lasting insecticidal nets- distribution and Operational Research).

**Overall Goal of the Programme**

To contribute to the improvement of the health status in Afghanistan through reduction of malaria associated morbidity by 50% and malaria related mortality by 80% by 2010.

To reach this goal 14 high prevalence target provinces were identified through analysis of past incidence data.

**Objectives:** There are 7 objectives within the program to be achieved. HealthNet TPO is responsible to implement objective 2 which is the largest component of the grant and objective 6 which is also a significant component to be implemented.

- **Objective 2:** To scale-up and improve coverage and quality of ITN (Insecticide Treated Net) implementation through...
existing and new channels in the 14 target provinces

Objective 6. To scale-up operational research to facilitate evidence based programming of malaria control activities.

Benefits: Total population of the 14 high malaria risk provinces is targeted that was estimated to be 11,606,600 in the beginning of the program with focusing on pregnant women and children under 5. According to 2008 estimation the total population of these 14 target provinces is 12,039,200.

Progress up to end of January 2009 (Phase 1):

The Global Fund Round 5 phase 1 was started on November 01, 2006 and ended by October 31 2008. After a late starting in April 2007, in spite of worst security situation in Afghanistan HealthNet TPO could have a titanic progress in implementation of the program and a huge number of mosquito nets were distributed to vulnerable and at risk population of fourteen high malaria risk provinces. The strategy was to distribute mosquito nets through public and private sector distributing outlets. The bed nets were sold to general public for a highly subsidized price while distributed for free to pregnant women during their first visit for ante-natal care services, children receiving DPT3 vaccination, school children, returnees, IDPs, nomads, orphans, hospital beds and some disable people. The distributed mosquito nets are long lasting insecticidal nets (LLINs) with efficacy of 3 – 5 years. Up to end of January 2009 a total number of 1,326,980 mosquito nets have been distributed. Of these 585,873 were distributed for free to pregnant women, children under 5, school children, returnees, IDPs, nomads, orphans and some other groups and 741,107 were sold for highly subsidized price to general public in 10 malaria high risk provinces.

For distribution of the mosquito nets a vast number of 966 service delivery points (distributing outlets) were established within the public sector (public health facilities) and private sector (private services providers).

Also for distribution of the LLINs a large number of 2,080 ITN implementers have been trained.

Bed nets distribution breakdown:
Number of mosquito nets sold for highly subsidized price: 741,107

Number of mosquito nets distributed to pregnant women: 297,331

Number of mosquito nets distributed to children under 1 receiving DPT3 vaccination: 141,185

Number of mosquito nets distributed to returnees: 67,500
Number of mosquito nets distributed through campaigning activities to school children, nomads, orphans, internally displaced persons and some other special groups: **147,357**

Insecticide Treated Nets distribution from 2007 till Jan 2009

Besides distribution of new mosquito nets, HealthNet TPO has re-impregnated a remarkable number of conventional nets with KO-TAB123 a long lasting insecticide and by end of January 2009 could retreat **179,123** bed nets.

**GF R5 phase II future perspective:**

The second phase of Global Fund R5 is started from February 01, 2009 and will continue till November 31, 2011.

Since the provision of Insecticide treated mosquito nets is a significant intervention for control of malaria in the BPHS, HealthNet TPO together with Ministry of Public Health promoted the distribution strategy for the Phase-II of GF Round 5 with further involvement of the BPHS and EPHS implementers. The strategy is to distribute long lasting insecticidal nets free of charge to pregnant women and children receiving pentavalent vaccination through the distributing outlets established within the BPHS and EPHS related health facilities of fourteen high malaria risk provinces. In addition some bed nets will be given to returnees through UNHCR related encashment centers in Nangarhar and Kandahar provinces. Also a small amount of bed nets will be as a buffer stock for any emergencies like outbreak etc. An amount of 78,613 LLINs will be distributed to nomads in Baghlan, Laghman and Nangarhar provinces in 2009.

To promote the coverage and utilization of the LLINs the distribution process will be accompanied with health education sessions, distribution of IEC materias including leaflets, installation of posters indicating availability of the bed nets in health facilities, flip charts using during health education sessions.
Future Perspectives: Global Fund, Round 8

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Overview of the R8 Grant
Malaria continues to remain as a major public health burden in Afghanistan and contributes to a considerable proportion of morbidity in the endemic provinces. It is highly endemic in areas below 2000 meters elevation from the mid-sea level. Ever since the present government took office in 2001, numerous attempts are made to best utilize available human and financial resources to sustain the growing stability and encourage revitalization of the overall health infrastructures in the country. The Basic Package of Health Services (BPHS) was devised in 2003 to ensure basic health care with appropriate attention towards malaria control strategies. Major donors such as The World Bank, USAID and EC have extended their cooperation to implement the package across the country. In this context, the MoPH and the National Malaria and Leishmaniasis Control Programme (NMLCP) have endorsed the Global and Regional Roll Back Malaria (RBM) strategies and the Millennium Development Goals (MDGs). In order to further strengthen existing measures, a gap analysis workshop was conducted in March 2008 and a National Malaria Strategic Plan (NMSP) has been developed for 2008-2013. The Global Fund to Fight Aids, Tuberculosis and Malaria (GFATM) has joined Afghanistan’s battle against Malaria in 2005. A comprehensive set of activities are being performed for prevention and treatment of malaria under this Grant. Distribution of Insecticide Treated Bed nets (ITNs) was entirely resourced by the existing GFATMR5 grant, especially for the pregnant women and children under five in all endemic provinces. In order to continue the existing efforts and expanding access to diagnostic outlets through establishing new laboratories, the GFATM has approved another spell of Grant (R8) scheduled to come into implementation in 2009.

Current status of Malaria Burden
Malaria is endemic in 29 out of 34 provinces in Afghanistan. The stratification of provinces is determined based on the malaria incidence. Although reliable epidemiological data are limited, a collaborative project supported by the European Community has mapped risk areas for Malaria transmission identifying 14 out of 34 Provinces with an estimated population of 14.4 million people as “high-risk”. Available HMIS data confirms that the majority of reported malaria morbidity occurs in these 14 Provinces, defined as Stratum 1 Provinces. Another 15 Provinces are considered “moderate-risk” areas (Stratum 2) with an estimated at-risk
population of 4.5 million and the remaining central highland areas are considered to have very little potential for malaria transmission (Stratum 3). In addition, other key affected populations considered at high-risk include Returnees from neighboring countries, Internally Displaced Persons (IDPs) and sizeable groups of nomads. The coordinated and progressively comprehensive strategies to control malaria prevalence have resulted in remarkable decline in the incidence rate.

However, most reported cases are diagnosed largely on clinical criteria. Access to diagnostic services is currently limited to Comprehensive Health Centers and few Basic Health Centers. Only presumptive treatment is available at community level and suspects are rarely referred by community health workers. Thus, “malaria” morbidity is most likely significantly over-reported and anti-malarial drugs are likely to be significantly over-utilized.

Proposed strategies

A comprehensive spectrum of activities has been planned under the upcoming R8 Grant. They are anticipated to sustain and expand the set of activities supported during the GF R5 Grant period. Early diagnosis and prompt treatment, prevention of transmission through promoting use of LLINs will be the major focus of R8 interventions. Key Strategies include introducing Rapid Diagnostic Tests (RDTs) at the community level, upgrading case management policies through revised evidence-based National Treatment Guidelines (NTGs) and promoting their proper utilization in both the public and private sectors, engaging Community Health Workers (CHWs) to provide Home-based Management of Malaria (HMM), utilizing new distribution modalities to provide free long-lasting insecticide-treated bed nets (LLINs), activating creative Behavioral Change Communications (BCC) modalities to improve awareness and promote behavior change, and strengthening Quality Assurance mechanisms in all aspects of Programme implementation. Specific measures are proposed to coordinate efforts for the prompt detection and control of epidemics, to improve Monitoring and Evaluation (M&E) activities and to strengthen Programme capacity to sustain this ambitious set of initiatives. Selected operational research activities have been designed to add to the scientific basis for continued strategic planning and to implement an aggressive integrated set of carefully-planned interventions to eliminate Plasmodium falciparum (P. falciparum) from the north-eastern border provinces.

Participatory approach with Co-Implementers

The R8 grant will be implemented in a broader partnership with two Co Principal Recipient. The successful experience of MoPH working with a wider group of CSOs (NGOs) for the
implementation of programmes in the recent past has been reflected through allocating more responsibilities for the two Co-PRs to work in close collaboration with the MoPH. In addition, all existing grants used for malaria related activities such as USAID funded lab establishment projects, IIRO supported piloting and Gates foundation resourced project to enhance access to ACTs will be counted in participation as collateral resources. Also, strategies have been planned over the R8 grant tenure to develop guidelines and create provisions to strengthen working collaboration between public and private sector care providers.

**Anticipated Challenges**

Different development initiatives by national and international organization have always been challenged by unprecedented security situation in Afghanistan. Removal of Taliban regime in 2001 followed by massive international military assistance has not been able to create and sustain stable security in the country especially in the eastern and southern provinces. On the other hand, extreme climactic condition is feared to interrupt program implementation. Although Malaria incidence is less likely to rise during snowy winter in some endemic provinces the mountainous geography leaves people living in hard-to-reach areas inaccessible for months. Apart from challenges posed by security and climate, another important obstacle could be resulted from failure to retain skilled human resources. Some extent of staff drop out was observed during previous round grant. Staff turnover issue has been considered with adequate priority while developing the R8 grant proposal and necessary precautionary measures have been included to mitigate the challenge.
Future Perspectives: Operational Research

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Operational research continues to play a role in planning. Globally, the majority of malaria research is conducted in Africa where the majority of mortality and morbidity is found. However, the epidemiological situation outside this area warrents conducting research to provide a locally applicable evidence base for policy - what is appropriate in Africa is rarely applicable to the setting of Afghanistan and the wider (South Asia) region.

The NMLCP and its partners have a broad range of research activities planned for the next three years in Afghanistan. In keeping with the long-used tradition of evidence based programming, a number of individual problems or challenges are evident to those who form the policies of the future. These questions are now formulated into specific research projects or collections of projects to address specific operational concerns.

In the next three years a full programme of research is planned, which compliments the work conducted to date and will provide primary data on which to base policy initiatives. It is expected that this programme of research will be conducted by the end of 2010 and results will not only be applicable to Afghanistan, but also to areas with similar epidemiology in South and Southeast Asia.

The projects are funded by a range of donors (including the Global Fund for AIDS TB and Malaria, Bill and Melinda Gates Foundation, and WHO/UNDP Special Programme for Research in Tropical Diseases. They can be broadly grouped into three categories:

Epidemiology and Factors Affecting Disease:

1) Sentinel Site Surveillance (GFATM): This project, incepted in 2008, will continue into the forseeable future. It aims to provide longitudinal disease data and epidemic detection and response. It is a key tool for evaluation of program impact and is the first of its type in Afghanistan’s history.

2) Evaluation of Disease Severity in Vivax and Falciparum Malaria (WHO/TDR): The project aims to quantify the problem of severe and complicated malaria and to re-examine the
commonly held belief that vivax malaria is a “benign” disease. There is an increasing body of evidence (mostly from Southeast Asia) that vivax malaria is more pathogenic than previously assumed and that this is an important and missing component from most areas where vivax is the primary cause of disease.

3) Prevalence of Glucose-6-phosphate-dehydrogenase (G6PD) Deficiency in Afghanistan (GFATM): This project aims to estimate the prevalence of G6PD deficiency in the Afghan population. Because of G6PD deficiency, primaquine (the only drug which can eliminate the dormant hypnozoite reservoir of vivax malaria) cannot be used; in patients with the deficiency, this drug can cause serious side-effects. It is unknown how prevalent this condition is. Knowing this information will assist in improving the national treatment guidelines.

Improving Access and Targeting of Effective Antimalarial Drugs:

1) Field Evaluation of Rapid Diagnostic Tests for Malaria (Bill and Melinda Gates Foundation; London School of Hygiene and Tropical Medicine; GFATM): Presently, most diagnosis in Afghanistan (and South Asia as a whole) is based on clinical diagnosis. New technologies have become available for rapid diagnosis of malaria which does not require microscopy. Although these have been shown to be sensitive and specific under controlled conditions, there is little evidence on their effect on treatment provision. This study aims to investigate the role of RDTs in targeting treatment at vivax and falciparum malaria in Afghanistan using a cluster randomised study design in the BPHS system of Kunduz and Nangahar Provinces, through Merlin and HealthNet TPO, respectively.

2) Antimalarial Drug Quality Monitoring (GFATM): There is increasing concern that counterfeit and substandard drugs are an increasing threat to malaria control in Asia. May tablets available in Southeast Asia have been shown to be either fake (deliberately packaged to resemble reputable brands), or substandard (locally manufactured generics that do not comply to quality control standards). This problem increases the chances of poor treatment outcomes, undermines public confidence in the most effective treatments, propogates anti-malarial drug resistance, and promotes disease transmission. Under GFATM a group will be conducting monitoring of antimalarial drug quality available in the public and private sectors by collecting samples and testing them at a drug quality testing facility.

3) Antimalarial resistance monitoring (WHO; GFATM; NAMRU-3): In order to monitor the effectiveness of commonly used antimalarial drugs, the clinical profile of malaria patients is measured
at three sites across Afghanistan using a standardised protocol. This project acts as an early warning system for drug resistance.

4) Referral for G6PD testing (WHO/TDR): In order to enhance access to effective antimalarial drugs, a pilot system of referral for G6PD testing will be conducted in two provinces. The system will refer all confirmed vivax malaria cases for G6PD testing at a central laboratory in the nearest district hospital. Once tested and if not G6PD deficient, the patients will be administered with primaquine. We will assess the impact on disease in patients, impact on disease transmission in the community and the cost-effectiveness of the intervention.

**Entomology and Vector Control:**

1) Anopheline Species Composition in Nangahar and Kunduz Provinces (GFATM): Longitudinal monitoring of mosquito species in different ecological zones will be collected over 2009-10 in two provinces. Since different anopheline mosquito species exist in Afghanistan, and may have differing vectorial capacities and behaviours, it is important to know which species contribute to malaria transmission in order to guide vector control measures.

2) Insecticide Resistance Testing (GFATM): With the increased availability of insecticide treated nets treated with pyrethroid insecticides, it is important to monitor levels of resistance to insecticide amongst mosquito species in Afghanistan. We will use a standard (WHO) resistance assays to identify phenotypic and genotypic resistance amongst mosquitoes collected in the wild in Nangahar and Kunduz.

3) Vectorial Capacity (GFATM): Some species of anopheles mosquitoes are more competent vectors than others. For this reason we will conduct a project to assess the frequency of infection with malaria (sporozoites) amongst mosquitoes collected over 2009-2010 in Nangahar and Kunduz. This also provides a baseline for measurement of effectiveness of vector control programmes.
Patrick Sieyes, Regional Director of Vestergaard Frandsen Middle East, discusses the company’s work in the Middle East and Central Asia. A key player in the malaria world, Vestergaard Frandsen is devoted to the innovation of lifesaving products. Millions of PermaNet, their long-lasting, insecticide-treated mosquito net, have already been distributed Afghanistan. Now a partner in local World Malaria Day events, the AAMJ finds out more about Vestergaard Frandsen’s activities to raise awareness of the disease throughout our region.

AAMJ: What does Vestergaard Frandsen do?

Patrick Sieyes: Vestergaard Frandsen is a Swiss-based company specializing in developing innovative solutions that prevent the transmission of vector-borne and water-borne diseases.

We are particularly interested in addressing the “Neglected Tropical Diseases,” which as their name suggests are rare diseases that do not attract a lot of attention or aid from the developed world and adversely affect some of the most vulnerable people on Earth.

We operate under a unique “Humanitarian Entrepreneurship” business model in which we have succeeded in turning humanitarian responsibility into core business by innovating directly for the developing world. Since Vestergaard Frandsen was founded in 1957, it has evolved into a multinational leader focused exclusively preventing the transmission of these diseases, reducing suffering and saving lives.

AAMJ: Tell me about your company’s history in the Middle East, and in Afghanistan specifically?

PS: We have been actively engaged in the malaria fight in the Middle East and Central Asia for the past five years through our regional office in Dubai. We are extremely proud of our historic achievements in Afghanistan, where more than 2,584,000 PermaNet® bed nets (Long-Lasting, Insecticide-Treated Nets) have been distributed and are protecting over five million Afghans from malaria. Our timely delivery and the renowned quality of our PermaNet® 2.0 LLIN have helped contribute to Afghanistan’s excellent performance and track record under the Global Fund Program. Much of the credit goes to the National Leishmaniasis Malaria Control Program and the Dutch NGO HealthNet TPO, while our strong coordination with both organizations has driven performance in the area of LLIN supply and distribution—a factor that has helped attract additional funding to the country.
AAMJ: Malaria, while widely regarded as an African problem, does not receive much attention in the Middle East. Why do you believe this is so?

PS: One reason there is little talk of malaria in the Middle East and Central Asia is the inherent nature of the geographical distribution of the disease. Africa accounts for 90% of malaria deaths and as a result attracts more interest. In the Middle East and Central Asia, malaria is localized in several countries such as Pakistan, Yemen and Afghanistan, which results in less attention on both the regional and international levels.

It's worth noting that although malaria deaths in the Middle East and Central Asia are thankfully far less prevalent than in Africa, it does represent a major health burden to our region and economy. Malaria-related suffering here is considerable, and the cost in terms of lost productivity, lost school days and medical expenses is also significant—and largely avoidable through the use of proven interventions like bed nets.

AAMJ: With whom does Vestergaard Frandsen partner in the region?

PS: Vestergaard Frandsen works mainly through partnerships because we believe in sustainability and high quality service for all our stakeholders. Fittingly, you can expect the majority of our stakeholders to partner with us either formally or informally. For example, we are the only LLIN manufacturer to have an official partnership agreement with the Ministry of Health in Sudan. We partner with MOH in Pakistan, Yemen, Iraq, Saudi and Egypt, in addition to most UN bodies, regional NGOs. Naturally, we work closely with the Afghani Ministry of Public Health as well as HealthNet TPO and our support for World Malaria Day in Afghanistan is a sign of such partnership.

AAMJ: Your PermaNet brand LLIN was launched five years ago. How many have been produced since this time?

PS: Since its humble beginnings in 2003, we have produced more than 175 million lifesaving PermaNet®, making Vestergaard Frandsen the world leader in LLIN production.

AAMJ: How are your products distributed to areas of need and at what cost to the consumer?

PS: Vestergaard Frandsen's business is divided into three segments: public equity, social marketing and commercial activities. To promote public equity, we work with our partners to make our products free to poorest of the poor. Often this aid is focused on pregnant women and children under five and recently on universal coverage called for by the UN.

Additionally, we pursue purely commercial activities. PermaNet® is available on the retail market in many countries. Vestergaard Frandsen is planning regional launches in Pakistan, Yemen and Sudan among the Middle East/Central Asia countries very soon.
Our partners’ target groups include pregnant women and children under five, victims of complex emergencies and the most vulnerable people on earth—refugees and the internally displaced. However, our unique social marketing and commercial activities can take us beyond such target groups into more widely defined demographic targets.

We believe everyone deserves a fair chance at building sustainable development, and this is achieved in good part by establishing a sustainable trade of lifesaving products.

**AAMJ:** Are there cultural barriers that need to be overcome when introducing PermaNet® into a community?

PS: It is often difficult to convince local populations that mosquitoes are more than simply a nuisance—they are deadly. Although we innovate and manufacture our products, it is our partners within local governments, MOHs, and NGOs that actually plan and implement PermaNet® distribution programs. Each distribution contains an educational element, and our partners have significant experience in educating the end-user on the dangers of malaria in general as well as correct net usage. Very often, we offer to contribute to the design of the IEC (Information and Education Campaign) materials to raise awareness and educate the end users.

**AAMJ:** What definitive health outcomes has PermaNet® achieved in terms of reducing the prevalence of vector-borne disease?

PS: PermaNet® has made an outstanding contribution towards reducing the incidence of malaria for people in developing nations by providing them with an inexpensive tool which prevents vector-borne diseases. Because more than 3,000 people die from malaria each day—mostly children—PermaNet® saves lives and reduces suffering on a massive scale.

According to the Cochrane Collaboration’s 2004 study on the use of LLINs to prevent malaria, LLINs like PermaNet® are the most effective tool for malaria control. As a result, LLINs are recommended by the World Health Organization (WHO) as a vital tool for saving lives in malaria-endemic areas.

Looking at specific cases, Eritrea, for example, has achieved great success in the fight against malaria. Between 2001 and 2006, a highly focused malaria program including PermaNet® LLINs was implemented following receipt of a Global Fund grant. The results speak for themselves: In this small nation of four million, malaria mortality has been halved for children under five and the total number of malaria inpatients has plummeted by 64%.

Taking these numbers into consideration, PermaNet® meets a critically important need in the developing world, where more than one million people each year lose the battle against this terrible disease.
AAMJ: What recent advancements have you made in terms of LLIN research and development?

PS: Vestergaard Frandsen is synonymous with research and development. We are fueled by our dedication to innovation, using this platform for technological breakthroughs to aid in changing the face of global health. First, we pioneered simple and easy-to-use bed nets that require no re-dipping or re-impregnating whatsoever. From our original breakthrough long-lasting, insecticidal net PermaNet® 2.0 that retains its effectiveness through 20 washes, we have now launched two additional bed nets, PermaNet® 2.5 with reinforced borders and PermaNet® 3.0 with higher efficacy particularly against resistant mosquito strains. We have also recently developed PermaNet® 2.0 Insecticidal Curtains, which protect from day-biting mosquitoes and other vectors, providing protection from malaria as well as dengue, leishmaniasis and Chagas disease.

AAMJ: Studies show insecticide resistance to pyrethroids, the active ingredients used in LLINs, is becoming a problem in many parts of the world in the absence of a safe and effective alternative insecticide class. What is Vestergaard Frandsen doing to address this important issue?

PS: Vestergaard Frandsen is literally reinventing the LLIN industry with PermaNet® 3.0. This is the only bed net that kills both susceptible and insecticide-resistant mosquitoes. PermaNet® 3.0 combines two proven fabrics – polyester and polyethylene – and two chemicals – Deltamethrin and a synergist – which together produce a stronger and softer bed net. PermaNet® 3.0 kills and repels mosquitoes, including those which are insecticide-resistant. This important breakthrough ensures that we have a useful tool to help us continue to prevent malaria tomorrow and into the future.

AAMJ: What innovative methods do you use to promote your products?

PS: September 2008 saw the launch of Vestergaard Frandsen’s breakthrough public health campaign called the Integrated Prevention Demonstration (IPD), which combined diarrhoea, malaria and HIV/AIDS disease control interventions. This unique public health campaign distributed over one million USD of our lifesaving products, including PermaNet®, without cost to the consumer. The pilot project took place within the Lurambi division of Kakamega central district, in the Western Province of Kenya.

Men, women and young people of reproductive age 15-49 years came out in tens of thousands to participate in the week-long HIV counseling and testing campaign. As encouragement for their participation, local residents received a lifesaving CarePack™ containing PermaNet® long-lasting insecticide-treated bed nets (LLINs), LifeStraw® water purifiers, condoms and educational materials for the prevention of
malaria, diarrhoeal diseases and sexually transmitted diseases, respectively.

**AAMJ**: What sets Vestergaard Frandsen apart from its competitors?

**PS**: For Vestergaard Frandsen, corporate social responsibility is core business. We concentrate uniquely on the developing world whereas the vast majority of business today—nearly all design, all innovation, all investment—targets only the top 10% of the globe. We do business for the world’s other 90%.

Our team is made up of 160 dedicated individuals in 11 offices worldwide who take the fight against malaria personally. Their imagineering, passion, precision, and speed of response make Vestergaard Frandsen the global leader it is today.

**AAMJ**: Looking towards the future, what does Vestergaard Frandsen envision as a future goal to be fulfilled in Middle East and specifically Afghanistan with regards to malaria?

**PS**: We dream of a malaria-free Middle East and a malaria-free Afghanistan in particular. To achieve this ultimate goal, malaria programs must receive additional funding from Middle-East based donors and further media attention to create awareness of the dangers of malaria. More cross-border coordination is also necessary to stop malaria from migrating, whether between Yemen and its neighbors or between Afghanistan, Iran and Pakistan.

Last but not least, we must see greater participation of the private sector, whether through companies’ individual initiatives or opportunities offered by the public sector for integration through Public-Private Partnerships. If everyone involved puts forth a concerted effort, we can win the fight against malaria in our lifetimes.
BRAC – Afghanistan

BRAC was born in 1972 in response to the crisis emerged amidst mass influx of returning refugees following the liberation war of Bangladesh in the preceding year. Initial efforts and attempts to help people resettle grew into a holistic approach with the course of time to create opportunities and sustain feasibilities. Subsequently, BRAC has created windows of truly diverse opportunities for 14 million people across 147,000 square kilometer Bangladesh in areas of Income Generation, Small and Medium Entrepreneurship, Health, Education, Agriculture and Livelihoods. BRAC has now become a large non-governmental development organization (NGO) with the twin objectives of poverty alleviation and empowerment of the poor. BRAC’s development programme targets the poor with special emphasis on improving their socioeconomic and health conditions.

BRAC Afghanistan carries the principal built on global best practices of development initiative focused on poverty alleviation and improvement of health status. BRAC Afghanistan believes in collaboration and works in a participatory approach with government, national and international stakeholders. BRAC has successfully become a partner organization of the Afghanistan government in various rebuilding activities in health, Microcredit, Education, Infrastructure and Social Development, Capacity Building, Agriculture and Livestock. Since registration in May 2002, BRAC Afghanistan has reached more than 20 million people in 25 out of 34 provinces in Afghanistan and has been reasonably accustomed with the socio cultural norms of the country.

BRAC Afghanistan's mission is aimed to develop the capacity of local partners. Consistent with it’s mission perspective, it has developed partnership for implementing health and non health projects since its inception in 2002. BRAC Afghanistan's health program is in partnership with two local organizations (BDN and ACTD). BRAC Education program sub-contracted 50 local organizations for community based primary education. Also BRAC Training and Resource Center (BTRC) is involved in building the managerial and financial capacities of 42 local organizations. With more than three decades of experience, blended with a global expansion strategy, BRAC embarked onto the international arena in the early 21st Century. Besides Afghanistan, BRAC is currently operating in Sri Lanka, Pakistan, Tanzania, Uganda, Indonesia, Liberia, Sierra Leone and Sudan. In 2006, BRAC established two non-profit organizations in the UK and the USA, each of them with its own Board of Trustees.

BRAC Afghanistan’s Malaria Control Programme is functional in 5 Provinces. In collaboration with the NMLCP and other agencies, BRAC is providing insecticide-treated bed nets and established 38 microscopy centers to widen access to
diagnostic services within the BPHS framework (7 DHs, 10 CHCs and 21 BHCs). On the eve of World Malaria Day 2009, as a Co Principal Recipient for upcoming Global Fund Round 8 Grant, BRAC Afghanistan further pledges to undertake greater responsibilities to work with Government to yield a country free of Malaria burden.

HealthNet TPO

HealthNet TPO is a Netherlands based not for profit, non-governmental organization founded on the principle that access to affordable quality health care is a basic human right. HealthNet TPO works with interdisciplinary professionals to develop and implement innovative, culturally appropriate, evidence based public health interventions with a focus on: innovative development of health systems (with focus on PHC), mental health and psychosocial program, control of communicable diseases (including malaria), and health financing schemes. HealthNet TPO offers ground-breaking and unconventional solutions that foster self-reliance and promote sustainable health care that is accessible to all.

HealthNet TPO Afghanistan; aims to support the local communities and the government of Afghanistan for the development of a sustainable health care system through the implementation of evidence based programs and capacity building in order to improve the health of the people of Afghanistan. HealthNet TPO is working in Afghanistan since 1994, implementing integrated health projects managed mainly by national staff supported technically by expatriate staff from head quarter office.

Health Care Support Program (HCSP):

HealthNet TPO started a model of primary health care program in Nangarhar during 1996. The model was based on concept of PHC where the system included community based health services through health workers up to district hospitals. This model has evolved and implemented in the province through three clusters linked to Nangarhar provincial hospital. HealthNet TPO expanded its services to Khost province in 2006 with focus on BPHS, using its experience in Nangarhar province. The project has significant achievements since its inception which is evident in quarterly reports and BSC results. HealthNet TPO intends to accomplish a comprehensive health services that will respond to the needs of the people from community to the provincial level based on its innovative/ tested approaches implemented in the other parts of the country. HealthNet TPO has recently signed a contract with MoPH to establish three sub centers in Khost province funded by GAVI Alliance for a period of forty months.

Malaria and Leishmaniasis control program: HealthNet TPO was one of the first organization to start working on malaria and leishmaniasis control program in early 90’s. The project is implemented since its inception in close coordination with MoPH where operation research is combined with implementation. This has
resulted in development of evidence based policies and strategies for the control of malaria and leishmaniasis in the country. HealthNet TPO is implementing a malaria control program in high risk provinces of the country (including Khost) funded by GFATM. The recent HMIS data indicates a significant reduction in the number of malaria cases as compared with the data for the last few years due to HealthNet TPO and MoPH intervention.

Mental Health Program (MHP): HealthNet TPO has pioneered the integration of mental Health in the PHC/BPHS and community based psychosocial services in Afghanistan since 2002. HealthNet TPO was able to provide technical support to BPHS implementers for integration of mental health in to BPHS in 12 provinces including 9 districts of Khost. HealthNet TPO has started a model psychiatric unit in Nangarhar hospital which will be the base for up gradation of psychiatric unit within Khost provincial hospital.

Private Public Partnership and Training of New Cadres of Health Workers in Uruzgan: HealthNet TPO assessment in Uruzgan shows very much limited number of qualified staff in public health facilities and low accessibility to health services due to inability of BPHS implementer to establish health facilities in insecure areas of the province. This resulted to initiate a new approach for involvement of private sector in quality service delivery mainly RH, EPI and control of communicable diseases. Similarly training of health workers to be qualified nurses, pharmacists and laboratory technicians are under process using the model of community midwifery training program which was started by HealthNet TPO in Afghanistan.