

## **Internally displaced human resources for health: villager health worker partnerships to scale up a malaria control programme in active conflict areas of eastern Burma**

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*(Received 2 July 2008; final version received 17 November 2008)*

Approaches to expand malaria control interventions in areas of active conflict are urgently needed. Despite international agreement regarding the imperative to control malaria in eastern Burma, there are currently no large-scale international malaria programmes operating in areas of active conflict. A local ethnic health department demonstrated that village health workers are capable of implementing malaria control interventions among internally displaced persons (IDPs). This paper describes how these internally displaced villagers facilitated rapid expansion of the programme.

Clinic health workers received training in malaria diagnosis and treatment, vector control and education at training sites along the border. After returning to programme areas inside Burma, they trained villagers to perform an increasingly comprehensive set of interventions. This iterative training strategy to increase human resources for health permitted the programme to expand from 3000 IDPs in 2003 to nearly 40,000 in 2008.

It was concluded that IDPs are capable of delivering essential malaria control interventions in areas of active conflict in eastern Burma. In addition, health workers in this area have the capacity to train community members to take on implementation of such interventions. This iterative strategy may provide a model to improve access to care in this population and in other conflict settings.

**Keywords:** internally displaced persons; villager health workers; human rights; human resources for health; malaria control

### **Introduction**

The international community agrees that a compelling moral and pragmatic imperative exists to ameliorate the malaria crisis in conflict areas of eastern Burma (Beyrer and Lee 2008). Among the most pressing issues facing the region is how to provide effective programme coverage in areas of active displacement, where ongoing conflict forces villagers from their homes, and where even stable villages may be several days' walk from a health clinic. Although, early diagnosis and treatment are

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essential to reduce malaria-related morbidity and mortality, high demand for clinical services strains the limited supply of trained-health workers. In order to expand the skilled human resources for malaria control in eastern Burma, the Karen Department of Health and Welfare (KDHW) and the Backpack Health Worker Team (BPHWT) have recruited locally trained village health workers (VHWs) to carry out day-to-day programme components, including malaria diagnosis, treatment and education.

Burma records the greatest number of malaria deaths and the highest malaria case fatality rate of any country in Southeast Asia (World Health Organisation (WHO 2005a, WHO 2005b). Multi-drug resistant *Plasmodium falciparum* (*P. falciparum*) is common (Wongsrichanalai *et al.* 2001, Rojanawatsirivet *et al.* 2004) and ubiquitous fake anti-malarial drugs compromise treatment effectiveness (Dondorp *et al.* 2004). The malaria crisis is particularly acute in eastern Burma, where decades of armed conflict have displaced more than 500,000 rural villagers (Thailand Burma Border Consortium 2007). Among internally displaced persons (IDPs) living in free-fire 'black zones', malaria accounts for 20–25% of overall morbidity (Back Pack Health Worker Team, unpublished case data) and over 40% of total mortality (Lee *et al.* 2006). 'Black zones' are areas designated as free fire zones, where active conflict with armed opposition groups leads to displacement and hinders the collection of health and other information. Prevalence of *P. falciparum* among IDPs in eastern Burma is substantially higher than among populations across the border in Thailand (Richards *et al.* 2007) and malaria prevalence in Thailand increases proportionately with proximity to the Burmese border (Wiwanitkit 2002). Tak Province, adjacent to Burma, historically records the most malaria cases in the kingdom (Zhou *et al.* 2005).

Despite the threat malaria poses to local and regional malaria control, the Burmese government operates no large-scale programmes targeting the disease in eastern Burma. In addition, increasingly restrictive government policies impede the ability of international humanitarian organisations to provide assistance (Stover *et al.* 2007). For example, in late 2005, the Global Fund for AIDS, Tuberculosis and Malaria terminated a US\$98.4 million country-wide contract (Global Fund 2005) and Médecins Sans Frontières (2006) was forced to close its modest malaria programmes in eastern Burma (Paung 2005). In 2007, the International Committee of the Red Cross reduced its operations in Burma by 90% and closed all five of its offices in eastern Burma (Cropley 2006). Although, other international funding mechanisms, such as the Three Diseases Fund, have partially filled the gap in service provision, the reach of this support remains limited to well-circumscribed areas, and there currently are no large-scale internationally supported malaria programmes operating in 'black zones' of Karen state in eastern Burma.

### Local responses to a chronic problem

Increasingly, the health service gap in eastern Burma is filled by community-based organisations with administrative training and supply centres located along the Thailand–Burma border. This approach represents a creative response to the challenges of delivering services in an active conflict area often hostile to international humanitarian assistance. In the 'black zones' of eastern Burma there are very few physicians or nurses; in order to address the human resource shortage,

community-based health organisations rely on trained local health workers as well as lay community members who have unique access to otherwise unreachable populations. Despite the challenges of this context, the malaria control programme of the KDHW and the BPHWT demonstrates the feasibility of delivering effective disease control interventions in an area of active conflict.

In Karen State, where decades of fighting have displaced several hundred thousand villagers (Thailand Burma Border Consortium 2004), health care is primarily provided by the KDHW and the BPHWT. As described elsewhere (Lee *et al.* 2007), KDHW reaches approximately 110,000 villagers by operating 33 health clinics throughout Karen State, each staffed typically by 10 local health workers and serving a catchment population of 3500–5000. In addition, over 70 teams of Backpack Health Workers, each comprised of two to five health workers, provide services to over 180,000 IDPs by visiting villages two to three times every six months. The Backpack teams in general work in the least stable areas, where up to 60% of households are displaced in any given year (Mullany *et al.* 2007). The KDHW clinics are likewise vulnerable to displacement: 12 have been uprooted or destroyed in the past five years. These clinics provide primary health and prevention services, and are able to maintain a consistent medicine supply and access to the population they support. In addition, they act as referral centres for treatment of complex cases occurring in Backpack team areas. Some of the department's clinics are equipped to handle more complex procedures for emergency obstetric and trauma cases. At any given time approximately, half of the clinic staff can be found in the local community performing disease screenings, treating patients and providing health education. Due to the remote, mountainous terrain, clinic-based health workers often must walk up to three days to reach villages in their catchment area.

The KDHW initiated a pilot malaria control programme in 2003 with technical support from the Global Health Access Programme, a non-governmental organisation based in the USA ([www.ghap.org](http://www.ghap.org)). Twelve local clinic health workers (CHW) from four clinic areas participated in the design, implementation and evaluation of the pilot programme, comprised of vector control using long-lasting insecticide treated nets (LLITNs), early diagnosis and treatment using Artemisinin-based combination therapy (ACT), and malaria education. Programme implementers conducted bi-annual screenings in each programme village as part of routine monitoring and evaluation. They also distributed LLITNs (DawaPlus Tana Netting Co., Siam Dutch Ltd., Bangkok, Thailand) to each household, or distributed insecticide tablets to impregnate untreated bednets (KO-Tab<sup>®</sup>, Bayer Environmental Science). House visits were regularly conducted to monitor net use, refer febrile patients and provide malaria education. Patients were diagnosed using a popular and accurate Histidine-rich Protein (HRP-II) antigen-based rapid diagnostic test (RDT) for *P. falciparum* (Paracheck-Pf<sup>®</sup>, Orchid Biomedical Systems, Goa, India), and were provided with a three-day course of mefloquine plus artesunate (MAS3) as the first-line treatment for *P. falciparum* infection, unless contraindicated. Febrile patients with negative results were treated for presumptive *P. vivax* infection with chloroquine. Treatment adherence was monitored through direct observation. Finally, programme implementers provided malaria education to villagers during distribution of LLITN or KO-Tab<sup>®</sup>.

As reported elsewhere, Richards *et al.* (2008), the pilot programme demonstrated the feasibility of delivering malaria control interventions cross-border to areas of

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active conflict in eastern Burma. Bi-annual surveys using Paracheck-Pf® to determine *P. falciparum* prevalence among asymptomatic villagers declined from over 8% to less than 2%, and incident cases decreased by approximately one-third. Confronted with the possibility of achieving substantial reductions in malaria morbidity in their populations, the KDHW and the BPHWT explored ways to expand the programme as rapidly as possible while preserving quality of care.

KDHW and BPHWT have rapidly expanded the reach of the malaria control programme since its inception in 2003. The programme that began as a pilot in four villages of 1800 IDPs now provides, as of mid-2008, integrated malaria control interventions to nearly 40,000 IDPs living in 51 villages. This rapid expansion was made possible by strategic training and use of VHWs (Shwe Oo 2008).

#### **Rationale for increasing the role of village health workers (VHWs)**

VHWs reduced the workload of CHWs facing increasing demands on their time as the programme expanded in their areas. When villages were added to the target areas of existing malaria programme clinics, there often were insufficient CHWs available to take on the new responsibilities and extensive travel. The severe shortage of health workers meant that each one would become responsible for increasingly large and remote populations. Requesting assistance from local villagers, who lived in the malaria programme's target community and were familiar with other village members, was a natural choice to more efficiently and effectively provide their target populations with early diagnosis and treatment and directly observed therapy (DOT).

The World Health Report (WHO 2006) noted that Burma faced a critical health worker shortage, and suggested that the 'simplification and delegation' of health tasks could facilitate improved access to care (WHO 2006). Table 1 illustrates how health worker density in the catchment areas of Karen state increases threefold when VHWs participate in malaria control service delivery. Although, the number of more highly trained CHWs has remained the same throughout programme expansion, the inclusion of VHWs has increased overall health worker density from 13 to 53 per 10,000 persons in the pilot areas. Thus, VHWs play a critical role in ameliorating the shortage of skilled health workers, especially in more remote areas with little or no access to healthcare.

Early confirmatory diagnosis and treatment and DOT is time intensive and threatens to consume time allocated for other clinic activities. As the primary managers of DOT, VHWs allow clinic workers to focus on more complex implementation tasks. With rising documentation of malaria drug resistance, ensuring that individuals are responsible for monitoring protocol adherence in their community supports regional efforts to stem the spread of drug-resistant malaria. Thus, the increased number of total malaria health workers serving the target population, up to a three-fold increase in health worker density in some areas, plays a role in both local health care delivery and regional malaria control.

Moreover, VHWs are a unique asset when looking to expand coverage to areas of active conflict with poor transportation infrastructure and hostile military patrols that limit the mobility and security of humanitarian workers. CHWs typically are based at a clinic, which can be a several days walk from villages in the catchment population. Many Backpack teams often find themselves over a week's walk away

Table 1. Malaria control programme clinic health worker (CHW) and village health worker (VHW) ratio and density in Karen State.

	2003		2004		2005		2006		2007		2008 <sup>b</sup>	
	Ratio	(Density)	Ratio	(Density)	Ratio	(Density)	Ratio	(Density)	Ratio	(Density)	Ratio	(Density)
Pilot areas												
Population	1820	3078	2970	3441	3215	3178						
CHW	1:455	(22)	1:770	(13)	1:743	(13)	1:860	(12)	1:804	(12)	1:795	(13)
VHW	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	1:357	(28)	1:244	(41)
Combined	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	na <sup>a</sup>	(na <sup>b</sup> )	1:247	(40)	1:187	(53)
Newer areas												
Population					7193		18830		30595		35969	
CHW					1:899	(11)	1:523	(19)	1:765	(13)	1:922	(11)
VHW					1:423	(24)	na <sup>a</sup>	(na <sup>b</sup> )	1:434	(23)	1:379	(26)
Combined					1:288	(35)	na <sup>a</sup>	(na <sup>b</sup> )	1:277	(36)	1:268	(37)

Note: Density = number of health workers per 10,000.

<sup>a</sup>Informally using VHWs so no data collected.

<sup>b</sup>2008 data only covers for the first six months.

from some target areas. In addition, Burmese government officials frequently target the CHWs, and security risks impede their ability to travel to remote villages (Karen Human Rights Group 2006). VHWs, on the other hand, live in the communities where they work, and are less conspicuous to military officials.

VHWs have enhanced continuity of the malaria programme during times of increased conflict. Deteriorating security situations occasionally force CHWs to cease all health-related activities, or to hide in the jungle to avoid retribution from the military. In such situations, the CHWs may leave a cache of tests and medicines with VHWs so that diagnosis and treatment can continue. As a result, use of VHWs has reduced the programme's vulnerability to new Burmese military operations.

### Evolution of village health workers (VHWs) trainings and responsibilities

From the onset of the pilot programme, village and district leadership were involved in planning village meetings to ensure community understanding and acceptance. The inclusion of VHWs began organically, as CHWs informally enlisted members of the community to assist with house visits, referral of symptomatic villagers and patient follow-up.

The villagers enlisted to assist with programme duties were typically school-teachers, youth, retired health workers and health worker spouses. CHWs informally trained these villagers to help carry out day-to-day, less technical programme responsibilities including conducting house visits to monitor net use and provide malaria education and observing daily malaria treatment initiated by the CHWs. In planning for expansion of the programme, the KDHW decided to formally include these villagers as 'VHWs'.

Currently, VHWs are formally recruited and trained to assist in key aspects of malaria programme implementation (Table 2). Villagers are eligible to become VHWs if they: live in the catchment village; have completed at least elementary level education; and are available to attend training and carry out their responsibilities. In many situations, the village leader assists in identifying potential VHWs from the community. VHWs' primary responsibilities include conducting regular house visits and distributing LLITNs, but the malaria programme health workers in each area determine more specific responsibilities based on their assessment of VHW

Table 2. Primary malaria control programme responsibilities for each type of health worker.

	Clinic health worker	Village health worker
Bi-annual malaria survey screening	X	
Diagnosis	X	X
Treatment		
Simple		X
Complex	X	
Malaria education		X
Net distribution		X
KO-Tab <sup>®</sup> distribution and net impregnation teaching		X
Referrals		X

competency and the geographic constraints of the target area. Official incorporation of VHWs into the programme allows them to receive regular, formal training and to work more effectively on the reduction of malaria morbidity and mortality in their community.

Programme workshops for CHWs were originally designed to teach all aspects of programme implementation, but they now serve mainly as a forum in which malaria programme health workers enhance their training skills so they can teach other clinic staff – and more importantly the VHWs – to carry out the daily programme components. Every six months, malaria programme health workers attend a ‘training-of-trainers’ workshop along the Thai-Karen State border where principles of adult learning theory inform participatory lessons regarding how to teach malaria treatment protocols, how to teach VHWs to provide malaria education and how to supervise VHWs. Supervision primarily entails accounting for supplies and checking treatment record forms for correct diagnosing and treatment. These workshops are also an opportunity to review programme data and compare effective strategies used in the field. This training-of-trainers approach minimises the number of individuals who must travel for training, as travelling to and from sites involves significant security risks and high costs. Only malaria programme health workers travel to these training sites; VHWs remain in the field and continue their normal programme activities.

When clinic workers return to their clinical sites in eastern Burma, they hold workshops to train new VHWs and refresh the skills of experienced VHWs. New VHWs shadow health workers for the first two months of their practice and assist as apprentices. Eventually, as the VHWs demonstrate increased capacity and the health worker becomes more confident in the VHWs’ skills, they work more independently using a treatment manual produced by the KDHW. Regular meetings are scheduled allowing health workers to supervise the work of VHWs and provide support for their activities.

### **Challenges to village health worker’s (VHW’s) effectiveness and sustainability**

The rapid enlistment of VHWs to assume increasingly complex programme tasks initially exceeded the capacity to train them or to monitor and evaluate their work. For example, VHWs in some areas were trained to diagnose and treat malaria before data forms had been developed for them to record test results or treatment choice. Furthermore, CHWs initiated informal VHW trainings prior to receiving formal training themselves in appropriate pedagogical tools. These informal training sessions and lack of data forms initially resulted in highly variable local care quality, and temporarily disrupted continuity of data collection. However, this early experience of engaging VHWs became an asset when CHWs came together to design training modules and simplify data collection instruments.

Another challenge faced when incorporating VHWs into the programme was CHW reluctance to delegate additional responsibilities to the VHWs. Some clinic workers lacked confidence in VHWs’ ability to perform more advanced skills and they were concerned that training and supervising VHWs would require more of their time – not less. Workshop discussions revealed that clinic worker concerns were primarily due to inadequate training of VHWs and a lack of strong guidelines for recruiting villagers. Workshop modules were modified to include suggested criteria

of VHW recruitment, and more robust training modules with roleplays and other participatory methods.

VHWs were enlisted to lessen the burden of CHWs' responsibilities. However, recruitment, training and supervision of VHWs became more time consuming for CHWs and presented a challenge to train them to become more efficient managers of their time. In most situations, CHWs trained VHWs but less time was allocated to supervision once the VHWs were officially part of the programme. In some cases, health workers did not have the ability to travel to and talk with the VHWs in their areas due to their responsibilities at the clinic. To address this challenge, timelines and scheduled meetings were organised during the workshop to improve time management.

Financial compensation for VHWs presented a challenge to the malaria control programme as it attempted to balance a fair reward structure with the competing financial needs of a larger health services budget. Although, many CHWs initially perceived VHWs as a volunteer workforce, VHWs now receive a small monthly stipend. Prominent members of the global health community have offered strongly worded arguments both for and against a volunteer or paid health workforce. In the dire setting of active conflict it became apparent to all participants that the cost of foregoing work or family duties simply was too high to expect villagers to work without compensation. In addition to the compelling moral argument in favour of fair compensation, the malaria programme team recognised that offering a small stipend would be required to increase worker retention and reduce the burden of repeatedly training new individuals. Although, the small stipend remains essential to the sustainability of the programme, convincing donors to support it remains a challenge, despite the extremely low cost (US\$3.50 per VHW per month). Many donors continue to consider human resources as 'overhead' costs to be minimised, and many defer support for VHW stipends that account for 27.8% of the human resource budget – but less than 4% of total programme costs (of approximately 110,000 for 2008).

Another programme challenge is the potential over-treatment of test-result negative patients. Despite most evaluations occurring in clinical settings where RDTs were later introduced to clinicians with previous experience diagnosing and treating malaria (Hamer *et al.* 2007), it is still possible that VHWs may be influenced by pressure from their fellow villagers to provide treatment. However, VHWs are trained to presumptively treat with a three-day course of chloroquine those febrile villagers who test negative, which preempts villager pressure to possibly treat negative test patients with an ACT. In addition, the programme attempts to minimise such situations by emphasising the importance of managing their limited number of malaria treatments to CHWs, and by linking the understanding of how supply misuse could lead to shortages for treatment of confirmed positive cases. Lastly, it is taking additional measures to monitor inventory and improve quality control by collecting the used RDTs. VHWs whose treatment use exceeds the number of positive cases will be provided with fewer RDTs and treatments, and will receive more intensive supervision by the local clinic worker.



## Discussion

A growing body of evidence supports the effectiveness of training villagers in early diagnosis and treatment of malaria in Southeast Asia (Carrara *et al.* 2006). This paper describes how these strategies can be modified to provide cross-border humanitarian assistance in an area of active conflict in Burma. While the specific implementation strategies of this malaria control programme are unique to the setting of chronic conflict, the engagement of community members to expand and enhance malaria control efforts is widespread. A recent comparative study of ACT delivery mechanisms in Cambodia highlighted the effectiveness of VHWs (Yeung *et al.* 2008). The national programme engaged Village Malaria Workers (VMWs) to diagnose and treat malaria using rapid tests, and provided them with nationally standardised ACTs and a monthly incentive of four US dollars. In programme areas, there was a marked reduction in the use of sub-therapeutic anti-malarials as well as increases in adherence to treatment protocols. While strikingly different from the KDHW programme in its capacity to deliver commodities to the field and provide health worker stipends from the national government, the Cambodia programme supports the view that malaria is best controlled by efforts that employ a diverse, community-managed team.

The Karen malaria programme faces several challenges similar to those identified in the Cambodian initiative. In the Cambodia study, 92% of therapies were taken without mefloquine in regions where blister packs were not available. The Karen programme packages combination therapies in plastic bags in order to maximise adherence, but manual repackaging unnecessarily consumes valuable human resources. Procuring recently co-formulated mefloquine-artesunate combination therapies remains a priority for programmes in highly drug-resistant areas. As noted by the Cambodia programme managers, population movement poses additional challenges to human resource training. Among newly resettled communities in the Anlong Ven region, a lower ratio of health workers to population resulted in intermittent gaps in service provision and villagers reported seeking private sector health care alternatives, including artemisinin monotherapies. In order to minimise similar disruptions in service provision during increasingly common episodes of forced displacement, the Karen programme takes advantage of the experience of an expanding core staff of community health workers, and explicitly focuses on the identification and training of community members to assume responsibility for malaria control efforts in each village. The programme's ability to scale up and respond to emerging disease threats is exemplified by the KDHW's response to an impending epidemic crisis in Ei Tu Ta, a new IDP camp.

In August 2006, Karen villagers fled armed conflict near the new Burmese capital and established a settlement along the Moei River separating Burma and Thailand. A bamboo clinic with a thatched roof was constructed to provide treatment for common illnesses. An initial malaria screening, performed with Paracheck by clinic staff, demonstrated 28% prevalence of *P. falciparum* among recent arrivals. As Ei Tu Ta's population grew to nearly 4000, education and follow-up screening in January showed that prevalence (18%) remained substantially above levels recorded during the dry season. The clinic workers recruited and trained 12 VHWs to help diagnose and treat camp members, to distribute LLITNs, and to provide malaria education. A year after the initial screening, an independent survey recorded *P. falciparum*

prevalence of 5% among IDPs residing in the camp over six months (Zwang *et al.* 2007). The ability to rapidly train and deploy VHWs in the field helped the KDHW to avert an epidemic.

The initial, informal use of VHWs during expansion of the malaria control programme highlights the responsiveness of local organisations to urgent health needs and their ability to develop absorptive capacity from within their communities. While some may argue that extensive human resources are a prerequisite for investment in programmes, the malaria control programme exemplifies the flexibility of local health organisations to expand and grow in an adaptive manner. Initial programme investment can lead to development of human resources appropriate to the situation, as communities with the most pressing needs and the most at stake will grow and develop their ability to meet the demands at hand. In addition, growth of absorptive capacity at the administrative level often precedes investment in programmes, as it is often funding that allows for the training and retention of workers and reduction of turnover. Involving local populations in programme implementation encourages a shift in the concept of absorptive capacity from a static property to a dynamic characteristic of systems that relies more on motivation and community need than on absolute numbers of personnel with pre-existing skills and experience.

The malaria control programme's formal incorporation of VHWs into the health care model has strengthened the system by targeting energy and funds towards primary health care tasks. This investment in community-level programme management minimises concerns regarding over-investment of financial and human resources in vertical programmes that can detract from essential primary care responsibilities. The development of community-based resources improves programme coverage and translates into more time for health workers to devote to non-malarial health activities. Furthermore, as caseloads in programme areas fall, surplus supplies can be distributed to expand the programme to new areas.

The VHW model complements the home-based management of malaria (HMM) initiative of the WHO and other organisations by promoting diagnosis and treatment closer to the home and reducing the likelihood of self-treatment (Were 2004). Despite the increasingly local and decentralised management structure of the VHW model, however, to date the malaria programme has not trained individual mothers in malaria case management. Although, maternal management remains an option, it was felt that the programme should first demonstrate the feasibility of training, adequately supplying and monitoring, at least one worker in each village. In addition, the programme managers feel that further evidence of the effectiveness of HMM in comparable areas of relatively low levels of malaria transmission (which is often less than 100 cases per 1000 per year in Karen programme areas) is necessary prior to scaling up in conflict areas.

Increasing the number of individuals in the community able to respond to disease outbreaks also enhances disease surveillance. While other initiatives have shown that wider disease surveillance is also possible through the use of technology, such as satellite phones (Mentor Initiative 2008), the constraints of eastern Burma are such that the use of VHWs is an appropriate first step to setting the foundation for more expansive surveillance in the future.

The training and use of VHWs represents a creative response to the global shortage of skilled health workers. Although, VHWs alone do not constitute a

comprehensive vision for primary health care, incorporating them into supervised systems enables the rapid increase of access to quality health care services among remote, conflict-afflicted populations. Furthermore, the basic set of skills VHWs use to diagnose, treat and refer and to collect data and manage supplies, can be applied to additional conditions or populations. As described elsewhere, KDHW and BPHWT have joined with other ethnic health organisations to establish a network of mobile obstetric medics who partner with traditional birth attendants to provide access to basic emergency obstetric care and transfusion to 60,000 villagers in rural areas of Burma (Mullany *et al.* 2008). In addition, the KDHW recently began an initiative to train malaria programme VHWs in basic management of other childhood illnesses, such as diarrhoea.

### Conclusion

VHWs provide a feasible means to effectively scale up cross-border malaria control interventions within the setting of active civil conflict. The training and supervision of VHWs to perform tasks previously delegated to CHWs may facilitate rapid scale-up of quality interventions in other health worker shortage areas. CHWs are capable of conducting these trainings in remote areas where security concerns limit direct participation of senior programme staff.

The iterative training strategy described above may provide a model for humanitarian programmes striving to reduce the burden of malaria in other situations for the estimated 20–25 million IDPs in the world (Office of the United Nations High Commissioner for Refugees 2006).

### Acknowledgements

The authors would like to thank the dedicated clinic health workers and village health workers who made this work possible.

### References

- Beyrer, C. and Lee, T.J., 2008. Responding to infectious diseases in Burma and her border regions. *Conflict and Health* (<http://www.conflictandhealth.com/series/1752-1505-Bur>) 2, 2.
- Carrara, V.I., Sirilak, S., Thonglairuam, J., Rojanawatsirivet, C., Proux, S., Gilbos, V., Brockman, A., Ashley, E.A., McGready, R., and Krudsood, S., 2006. Deployment of early diagnosis and mefloquine-artesunate treatment of falciparum malaria in Thailand: the Tak Malaria Initiative. *PLoS Medicine*, 3, e183.
- Cropley, E., 2006. Reuters: Red Cross says Myanmar junta stops prison visits. *BurmaNet News*, 27 January.
- Dondorp, A.M., Newton, P.N., Mayxay, M., Van Damme, W., Smithuis, F.M., Yeung, S., Petit, A., Lynam, A.J., Johnson, A., Hien, T.T., McGready, R., Farrar, J.J., Looareesuwan, S., Day, N.P.J., Green, M.D., and White, N.J., 2004. Fake antimalarials in Southeast Asia are a major impediment to malaria control: multinational cross-sectional survey on the prevalence of fake antimalarials. *Tropical Medicine and International Health*, 9 (12), 1241–1246.
- Global Fund, 2005. *Termination of grants to Myanmar*. Available from: [http://www.theglobalfund.org/en/media\\_center/press/pr\\_050819\\_factsheet.pdf](http://www.theglobalfund.org/en/media_center/press/pr_050819_factsheet.pdf) [Accessed June 1, 2008]
- Hamer, D.H., Ndhlovu, M., Zurovac, D., Fox, M., Yeboah-Antwi, K., Chanda, P., Sipilinyambe, N., Simon, J., and Snow, R.H., 2007. Improved diagnostic testing and malaria treatment practices in Zambia. *Journal of the American Medical Association*, 297 (20), 2227–2231.

- Karen Human Rights Group, 2006. *Toungoo district: the civilian response to human rights violations*. Available from: [www.khrg.org/khrg2006/khrg06f8.html](http://www.khrg.org/khrg2006/khrg06f8.html) [Accessed June 12, 2008]
- Lee, T.J., Mullany, L.C., Richards, A.K., Kuiper, H.K., Maung, C., and Beyrer, C., 2006. Mortality rates in conflict zones in Karen, Karenni, and Mon states in eastern Burma. *Tropical Medicine and International Health*, 2 (7), 1119–1127.
- Lee, T.J., Mullany, L.C., Richards, A.K., Maung, C., Htoo, M., and Mahn, M., 2007. Burma: the impact of human rights violations on health among internally displaced persons in conflict zones. In: C. Beyrer and H.F. Pizer, eds. *Public health and human rights: evidence-based approaches*. Baltimore, MD: Johns Hopkins University Press, 33–64.
- Médecins, Sans Frontières, 2006. *Medical charity pulls French staff from Myanmar*. France: Agence France-Press.
- Mentor Initiative, 2008. Helping to develop cutting-edge tools for the control of malaria. ARGOS [online]. Available from: <http://www.thementorinitiative.org/controltools.html> [Accessed July 7, 2008]
- Mullany, L., Lee, C., Yone, L., Paw, P., Oo, S., Maung, C., Lee, T., and Beyrer, C., 2008. The MOM project: delivering maternal health services among internally displaced population in Eastern Burma. *Reproductive Health Matters*, 16 (31), 44–56.
- Mullany, L.C., Richards, A.K., Lee, C.I., Suwanvanichkij, V., Maung, C., Mahn, M., Beyrer, C., and Lee, T.J., 2007. Population-based survey methods to quantify associations between human rights violations and health outcomes among internally displaced persons in eastern Burma. *Journal of Epidemiology and Community Health*, 61, 908–914.
- Office of the United Nations High Commissioner for Refugees, 2006. *The state of the world's refugees 2006: human displacement in the new millennium*. Oxford University Press. (published in 2006).
- Paung, S., 2005. Another international aid group pulls out. *The Irrawaddy*, 20 December [Accessed June 6, 2008].
- Richards, A.K., Banek, K., Mullany, C., Lee, C., Smith, L., Oo, S., and Lee, T., 2008. Cross-border malaria control for internally displaced persons: observational results from a pilot program in eastern Burma/Myanmar. *Tropical Medicine & International Health*, 1, (in press).
- Richards, A.K., Smith, L., Mullany, L., Lee, C., Whichard, E., Banek, K., Mahn, M., Oo, S., and Lee, T., 2007. Prevalence of *Plasmodium falciparum* in active conflict areas of eastern Burma: a summary of cross-sectional data. *Conflict and Health*, 1–9.
- Rojanawatsirivet, C., Congpuong, K., Vijaykadga, S., Thongphua, S., Thongsri, K., Bangchang, K.N., Wilairatana, P., and Wernsdorfer, W.H., 2004. Declining mefloquine sensitivity of *Plasmodium falciparum* along the Thai-Myanmar border. *Southeast Asian Journal of Tropical Medicine and Public Health*, 35, 560–565.
- Shwe Oo, E.K., 2008. Community-based malaria control among IDPs in eastern Burma. Paper presented at the Annual Global Health Council Conference, Washington, DC. Presented on May 31, 2008
- Eric Stover, Voravit Suwanvanichkij, Andrew Moss, David Tuller, Thomas J. Lee, Emily Whichard, Rachel Shigekane, Chris Beyrer, David Scott Mathieson. 2007. *The gathering storm: infectious diseases and human rights in Burma*. Berkeley, CA: Human Rights Center, University of California.
- Thailand Burma Border Consortium, 2004. *Internal displacement and vulnerability in eastern Burma*. Available from: <http://www.tbtc.org/idps/report-2004-idp-english.pdf> [Accessed July 7, 2008]
- Thailand Burma Border Consortium, 2007. *Internal displacement in eastern Burma: 2007 Survey*. Available from: <http://www.tbtc.org/idps/report-2007-idp-english.pdf> [Accessed September 4, 2008]
- Were, W., 2004. *Bringing malaria management closer to the home*. Available from: [http://www.who.int/malaria/docs/Home\\_management\\_of\\_malaria2.pdf](http://www.who.int/malaria/docs/Home_management_of_malaria2.pdf)
- Wiwanitkit, V., 2002. High prevalence of malaria in Myanmar migrant workers in a rural district near the Thailand-Myanmar border. *Scandinavian Journal of Infectious Disease*, 34 (3), 236–237.
- Wongsrichanalai, C., Sirichaisinthop, J., Karwacki, J.J., Congpuong, K., Miller, R.S., Pang, L., and Thimasarn, K., 2001. Drug resistant malaria on the Thai-Myanmar and Thai-

Cambodian borders. *Southeast Asian Journal of Tropical Medicine and Public Health*, 32 (1), 41–49.

WHO Regional Office for South-East Asia, 2005a. *Malaria: disease burden in SEA region*. New Delhi.

WHO, 2005b. *World malaria report 2005*. Geneva. Available from: <http://www.rbm.who.int/wmr2005> [Accessed June 6, 2008].

WHO, 2006. *World health report 2006: working together for health*.

Yeung, S., 2008. Access to artemisinin combination therapy for malaria in remote areas of Cambodia. *Malaria Journal*, 7, 96.

Zhou, G., 2005. Spatiotemporal distribution of *Plasmodium falciparum* and *P. vivax* malaria in Thailand. *American Journal of Tropical Medicine and Hygiene*, 72, 256–262.

Zwang, J., Maung, L.K., and Nosten, F., 2007. *Ei Tu Ta malaria prevalence survey, 1 July 2007*. Shoklo Malaria Research Unit.