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Editorial

# Eliminating lymphatic filariasis – the surveillance challenge

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Lymphatic filariasis (LF) is an important neglected tropical disease. Although many LF infections are asymptomatic, the long-term sequelae of elephantiasis, lymphoedema and hydrocoele can have devastating physical, psychological, social and economic consequences for individuals and for communities where this disease is endemic (Ottesen *et al.* 1997; Wynd *et al.* 2007). LF is one of the leading causes of disability worldwide and there are more than 119 million people infected (Michael *et al.* 1996). In 1997, WHO launched the Global Programme to Eliminate Lymphatic Filariasis, which aims to eliminate LF from 80 countries in which it is endemic, by the year 2020. The primary strategy is to use mass drug administration (MDA), with a combination of two drugs, given annually to the entire 'at-risk' population (World Health Organization 2000). In the Pacific region, several countries had recently completed their planned number of rounds of MDA and now need to make important programmatic decisions. Perhaps the most important of these decisions relates to future surveillance needs.

## The Pacific Programme

The Pacific Programme to Eliminate Lymphatic Filariasis was launched in 1999, under the auspices of WHO. Since then, 11 endemic countries have commenced MDA campaigns using a combination of diethylcarbamazine (DEC) and albendazole. Several countries have now completed five rounds of MDA and are ready to consider stopping MDA and beginning post-MDA surveillance.

One of the main premises of the Global Elimination Programme is that once the antigenaemia prevalence in the 6–10-year age group throughout the country falls below 0.1%, transmission will be interrupted permanently (World Health Organization 2000). In order to reach this goal of <0.1% antigenaemia, the principal strategy is to provide four to six rounds of MDA to a high proportion of the population. Recent data from the Pacific Programme provide evidence to support this strategy: countries that achieved a high coverage in five rounds of MDA recorded low prevalence of LF antigenaemia in post-MDA-stratified cluster sample surveys in the general population. Whether this strategy will interrupt transmission permanently in all endemic countries remains unclear and mathematical modelling has suggested that more rounds of treatment may be required depending on the intensity of transmission as well as the local species of mosquito vector (Michael *et al.* 2004).

The Pacific region has several reasons to feel vulnerable. Firstly, there are historical reports of Pacific Island countries experiencing resurgence, following the cessation of mass treatment campaigns that had reduced the LF prevalence to extremely low levels (World Health Organization 2006). Maupiti, an isolated island community in French Polynesia, which participated in mass treatment campaigns and prevalence surveys for more than 34 years is one example (Esterre *et al.* 2001). Within this island's very stable population, microfilaraemia prevalence was documented as 0% in 1985 and 1989 after mass drug treatment campaigns with DEC. However, a repeat survey in 1997 found a microfilaraemia prevalence of 0.4%, with an antigenaemia prevalence of 4.6% (Esterre *et al.* 2001). While this particular treatment campaign did not use combination therapy, it does raise concern about recrudescence of detectable infection after apparently successful MDA campaigns.

Another compelling argument for maintaining vigilance is the presence of a highly efficient vector, *Aedes polynesiensis*, which is the dominant vector in many Pacific Island countries. This day-biting mosquito is able to breed in crab holes, making most vector control measures impractical. It has a trait called 'limitation', i.e. its efficiency in transmitting microfilariae rises as the intensity of microfilaraemia within the population falls (Burkot *et al.* 2006). Thus


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a small residual focus of infection may serve as a reservoir for ongoing transmission and lead to resurgence of clinical disease.

A potential, as yet unexplored, threat is migration of infected individuals between or within countries. The movement of people between islands within the one country is common in the Pacific (World Health Organization 2006). The migration of people to neighbouring countries is also common, as illustrated by the vast number of Cook Islanders (51 141) living in New Zealand, compared with the relatively small population living in the Cook Islands (18 027) (Stahl & Appleyard 2007). Similar migration patterns exist for Niue, Tokelau and Samoa, and to a lesser extent for other Pacific Island countries. This trend has implications for the success of the current country elimination programmes, as well as future surveillance efforts in that the main reservoir of the parasite, for some countries, may reside in non-endemic areas where no MDA has been conducted. The threat posed by migration has been identified in other regions (Sunish *et al.* 2003). The importance of people who move, thereby missing MDA treatment, and then return to previously endemic areas in the Pacific is unknown. If vectors are not eliminated, it is biologically plausible that a single infected individual could serve as a source of renewed transmission.

Finally, stratified cluster sampling which is used to guide decisions on terminating MDAs in the Pacific, has important limitations in judging the elimination of LF. In many other regions, in accordance with the WHO guidelines (World Health Organization 2000), lot quality assurance sampling will be performed to determine whether or not transmission has stopped. Both methods perform well when there is a reasonably homogenous distribution of infection. Unfortunately, LF may be extremely heterogenous within an endemic area, even varying significantly between neighbouring villages (Washington *et al.* 2004). A focus of infection can exist in one village, while a neighbouring village will not have any cases. Therefore, unless the 'clusters' or 'lots' are very small, probably reduced to village level, one cannot be certain that all foci of transmission have been eliminated.

## Ongoing lymphatic filariasis surveillance

Given the risk of resurgence in the Pacific region, ongoing surveillance with an active component that detects and eliminates continuing transmission will be required. However, implementing an ongoing surveillance programme in the Pacific presents many challenges that will also be faced by other regions attempting to confirm the elimination of LF. Surveillance programmes will need to work within the confines of under-resourced health systems. Existing strengths, such as school-based health programmes, should be explored to identify opportunities for integration (Hotez *et al.* 2007).

The remote nature of the Pacific Island countries means that many communities are isolated and relatively inaccessible. An ongoing surveillance system that aims to detect remaining foci of transmission and new transmission will need to ensure that all populated geographical areas are adequately sampled. One approach is to choose a single age group and test most individuals in that group. This would replace the need for complex sampling strategies that may be difficult for staff with limited training or experience in survey design and implementation. A suitable example may be a school year group, in countries where school attendance is high, as this would sample all children in a particular age range, and children may be easily accessible through the school system.

Currently field surveillance for LF relies on the rapid immuno-chromatographic antigen test (ICT), which requires little technical expertise and for which results are available within a few minutes. Its major limitation is that it does not detect very early infection and it remains positive for some time (months) after the death of an adult worm (Weil & Ramzy 2007). Another testing method widely used in the Pacific is direct microscopy, which detects microfilariae in blood but often requires nocturnal testing. Microscopy has the limitation of requiring a skilled microscopist. In addition, the sensitivity decreases sharply as the worm load within an individual declines, which occurs when the community prevalence is low. New testing methods, based on detection of antibody, are being evaluated and will hopefully lead to the production of more sensitive tools to identify recent infection or exposure to infection. In the meantime, using children aged 6–10 years as markers of transmission may be the most appropriate option in the Pacific, as this cohort was born after the start of MDA campaigns and therefore, one would expect them to be negative and not harbouring an adult worm. An antigen-positive child indicates that transmission is still occurring in their community, and this marker can then be used to detect and treat the source of transmission.

## Conclusion

Several countries in the Pacific are nearing the end of their scheduled MDA campaigns to eliminate lymphatic filariasis (LF). Historical records indicate that LF is capable of resurgence in this region, even from very low levels. In addition, the Pacific has an efficient vector and a mobile

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population. Ongoing LF surveillance needs to be active and action oriented, to systematically ensure that transmission of LF has ceased in all geographical areas of a country. It should be a simple, yet flexible system that can be easily implemented in a challenging environment, while producing valid planning information to guarantee that the remarkable gains of this elimination programme are not lost.

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