VANUATU

APPLICATION FOR THE VERIFICATION OF THE ELIMINATION OF LYMPHATIC FILARIASIS AS A PUBLIC HEALTH PROBLEM

Draft 4. 17 July 2013

1. General description

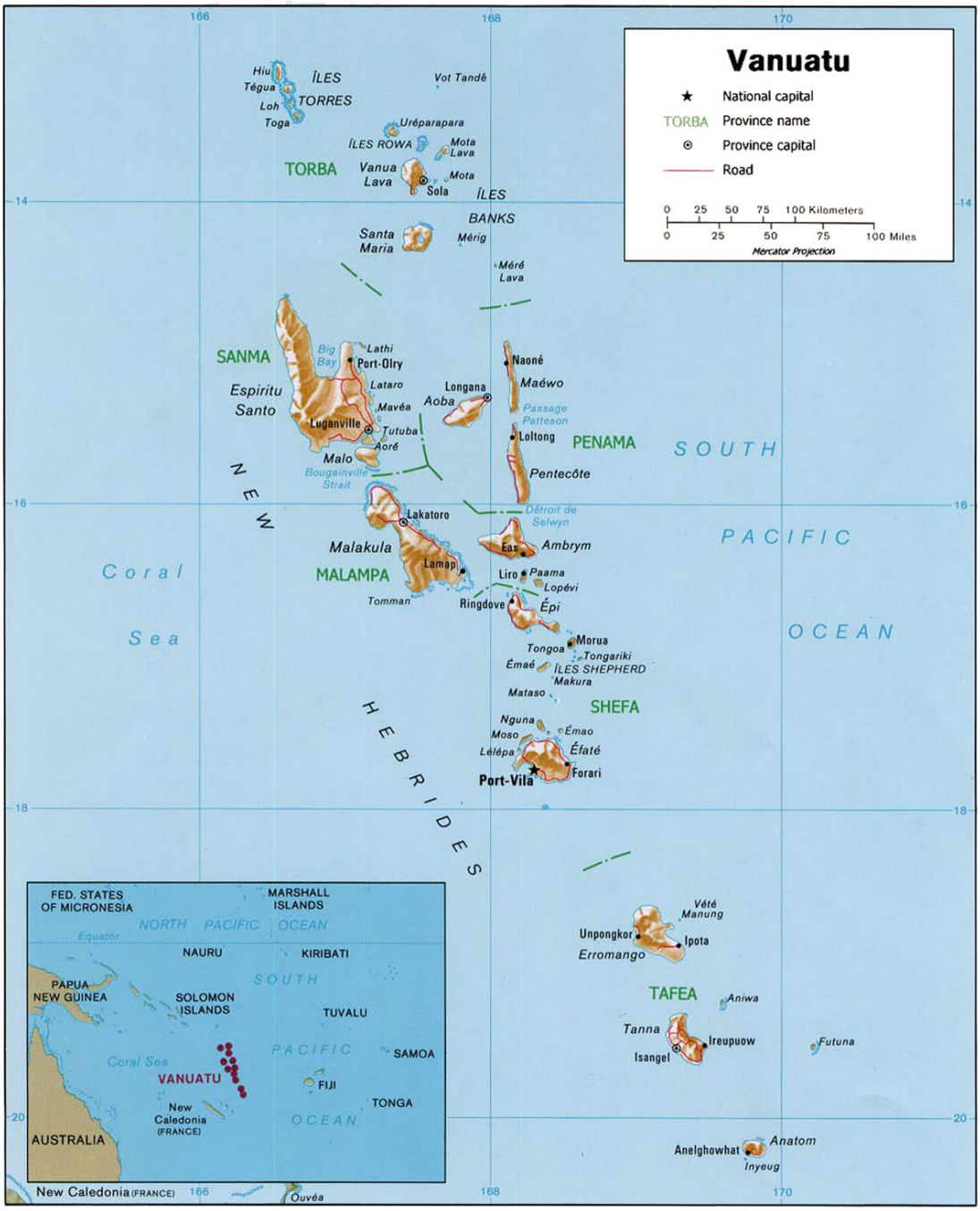
1.1 Geographical and economic features of the country, particularly as they relate to risk of LF transmission

Vanuatu consists of an archipelago of islands located between 12° to 21°S and 166° to 171°E (Figure 1). It has a land area of 12,195 sq km. There are six provinces: Torba, Sanma, Penama, Malampa, Shefa and Tafea. The capital, Port Vila, is located on Efate Island in Shefa Province. The official languages are Bislama, French and English.

The population at the 1999 census was 186,678 and in 2009 was 234,023 (National Statistics Office Vanuatu, 2009), representing an annual growth rate of 2.3% over the ten year period. The number of households increased from 36,415 in 1999 to 47,373 in 2009. The average household size is 4.8 persons.

The mean population density is 19 persons per sq km, ranging from 11 in Sanma and Torba provinces to 52 in Shefa province. The urban population (mainly located in two towns of Luganville on Santo island in Sanma province and in Port Vila on Efate Island in Shefa province) increased from 21.5% of the total population in 1999 to 24.4% in 2009. The population of the capital Port Vila was 44,040 in 2009. Population by province is shown in Table 1.

Figure 1: map of Vanuatu showing Province boundaries



Source: mappery.com

Table 1: Provinces of Vanuatu with population and growth rate, 1999-2009

PROVINCE	No. of main islands	Population 1999	Population 2009	Annual growth rate (%)
TORBA	14	7,757	9,359	1.9
SANMA	11	36,084	45,860	2.4
PENAMA	3	26,646	30,819	1.5
MALAMPA	17	32,705	36,722	1.2
SHEFA	15	54,439	78,723	3.7
TAFEA	5	29,047	32,540	1.1
VANUATU TOTAL	65	186,678	234,023	2.3

School attendance was above 70% in 2009 for both boys and girls for ages 5 years through 14 years. It reached 85% or above for ages 7 through 12 years. In 2009, 76% of households reported having at least one bednet, ranging from 52% of households in Shefa province to 98% of households in Torba province (National Statistics Office, 2009). Household ownership of mobile phones in 2009 was also 76%, ranging from 10% in Torba province to 87% in Shefa province.

The gross domestic product per capita in Vanuatu was $3094 in 2011 (World Bank, current USD value method; www.worldbank.org). Vanuatu ranks as a lower middle-income country according to the World Bank. The household income and expenditure survey results of 2007 found a poverty gap ratio of 5.6% (3.8% in the rural areas and 10.4% in Port Vila) indicating severe poverty levels in the capital. Sixteen per cent of the total population was living below the basic needs poverty line and 7 per cent were experiencing food poverty (Government of Vanuatu, Annual development report, 2009).

1.2 The health system, emphasizing the adequacy of the health system to detect cases of infection and provide treatment

The under-5 mortality rate was 11.2 per 1000 in 2011 (World Bank: http:// data.worldbank.org/data-catalog/world-development-indicators?cid=GPD_WDI). Life expectancy at birth was 71.1 years. There are 0.12 physicians, 1.7 nurses and midwives, 0.95 community health workers and 1.7 hospital beds per 1000 people. In 2011, 74% of births were attended by skilled birth attendants. Improved sanitation is accessible to 57% of the population and improved water sources to 90%. In 2011, 68% of children aged 12-23 months received DPT and 52% had received measles immunization.

There are five main hospitals; one in each of the five larger provinces. (Lum On et al , 2010) .The two key referral hospitals are located in Port Vila (Vila Central Hospital) and

Luganville (Northern District Hospital), offering inpatient and outpatient care. A number of health centres and dispensaries also operate in urban areas, and are run by municipal administrations, churches or nongovernment organisations. Beyond urban areas, each province is divided into catchment zones for the purposes of coordinating community health care, including public health programs. Throughout Vanuatu, there are 32 health centres, 89 dispensaries and 181 aid posts (ODE AusAID 2009). Aid posts are community owned, and staffed by a volunteer village health worker with limited experience.

The prevalence of malaria (all species) was 0.6% by slide and 2.0% by PCR in 2011 (Vanuatu Malaria Indicator Survey). There is enhanced surveillance for malaria through a recently revised Malaria Information System that collects line listings of cases but most of the malaria diagnosis is done by rapid diagnostic tests rather than slides. Only about 10% of facilities have microscopists. Therefore the likelihood of identifying microfilariae on a blood smear is low.

Vanuatu has recently installed a new health information system (HIS) for reporting from all levels of health facilities. The new HIS form includes a line for LF cases and numbers are being reported, but the case definition is unclear.

1.3 Geographical distribution, feeding behaviour, density and competence of the vector mosquitoes

The vector of LF in Vanuatu is *Anopheles farauti* (Belkin, 1963; Ree et al 1991). This is present throughout the islands. It is a night-biting mosquito that feeds both inside and outside houses. It breeds in water on the ground, for example swamps, ditches, puddles and along stream banks. Byrd and St Amant (1959) tested two *Culex* and four *Aedes* species but found complete larval development only in *An.farauti*. Up to 13.7% of *An farauti* mosquitoes were infected with LF larvae (all stages). The nocturnal periodicity of *W.bancrofti* in Vanuatu and its relationship to biting times of *An.farauti* was investigated and demonstrated by Abe et al (2003).

1.4 Immigration patterns to and from LF-endemic areas (including other countries)

The following airlines fly from Australia to Vanuatu with multiple flights per week: Qantas, Air Vanuatu and Virgin Australia. There are also flights from New Zealand and regular cruise ships docking at Port Vila and Aneityum. The majority of the tourists arriving in Port Vila are from Australia and New Zealand, with extremely low chance of importation of LF from those countries.The other close neighbours of Vanuatu are Solomon Islands (now non-endemic for LF), New Caledonia (partially endemic), Fiji, and Papua New Guinea. The highest risk is likely to be from Fiji, with direct flights to and from both Nadi and Suva, and passengers arriving through those airports from other Pacific Islands. The airlines operating are Fiji Airways, Air Vanuatu, Solomon Airlines, Air Calin and Air Pacific which go through PIC countries. Airlines practice insecticide spraying at destinations but it not known if this practice is always adhered to. An estimated 13% of the tourists visiting Port Vila are from New Caledonia. In the month of April 2013, the number of passengers arriving from other neighbouring countries were as follows:

Table 2: Visitor arrivals from Pacific countries

NATIONALITY	No. Of Visitors
FEDERATED STATES OF MICRONESIA	2
FIJI	163
INDIA	1
KIRIBATI	8
MARSHALL ISLANDS	8
NAURU	3
PALAU	1
PNG	65
SOLOMON ISLANDS	95
TONGA	19
TUVALU	6
WESTERN SAMOA	12
TOTAL	**383**

Source: Vanuatu tourism agency

Within Vanuatu, all internal flights are operated by Air Vanuatu. The approximate number of passengers carried per day between islands is 394.

There are inter-island ships running approximately 2 times per week to the major ports. The approximate number of people moving by ship each week between islands is 70 passengers per voyage.

The University of the South Pacific (USP) in Port Vila receives students from all anglophone Pacific nations to study law. Ni-Vanuatu students go to USP in Fiji, UPNG in Papua New Guinea and USP Alafua in Samoa for extended periods to study medicine, pharmacy or other degrees. An estimated 217 scholarships are awarded annually for the Ni-Vanuatu students. Of these countries, Fiji and Samoa through ELF campaigns, have reduced the transmission to very low levels. Chances of returning students bringing infection to Vanuatu are unlikely to be high. This group of population has not been known to be parasite carriers. For instance, all new students from Pacific Island countries at the University of the South Pacific were tested using ICT in February 2011, but there no positives of 101 sampled.

1.5 Occurrence of LF in neighbouring countries and the status of filariasis control or elimination efforts in those countries

As an island nation, Vanuatu is relatively isolated from its neighbours. To the north, Solomon Islands apparently eliminated LF by the 1970s and is now classified as a non-endemic country. LF disappeared from Solomon Islands concurrently with the malaria elimination (later control) program, which used extensive DDT indoor residual spraying campaigns, and therefore elimination of LF from the Solomons has been ascribed to the malaria program (Webber et al, 1975). To the south, New Caledonia is partially

endemic, with transmission apparently occurring in small foci only. There is currently no national MDA or other LF program there. Fiji, located to the east of Vanuatu, had very high prevalence of LF but has a very active control program based on MDA and additional strategies such as Test and Treat. Prevalence is now very low on the west side of the country, nearest Vanuatu.

2. History of lymphatic filariasis

2.1 A detailed description, including maps of historic foci of LF transmission, as documented by both government and research efforts. According to Sasa (1976) the prevalence of filariasis in Vanuatu before 1950 was 30%. The prevalence of LF and its geographic distribution up to the 1950s was summarized in a series of reports produced by the South Pacific Commission, which include references to Vanuatu (formerly New Hebrides). SPC (1954) summarized prevalence survey since 1862 and Iyengar (1954) detailed 20 surveys of LF in Vanuatu with sample sizes of 1 to 732 persons tested, with prevalence ranging from 0% to 60% (excluding one survey site with 1 tested, 1 positive). Iyengar (1956) is an annotated bibliography mosquitoes of the South Pacific Region while Byrd and St Amant (1959) reviewed studies on the epidemiology of filariasis on central and south Pacific islands. For Vanautu, surveys on 12 islands or island groups showed a prevalence of 21.7% positive (N=396). In adults (>15 years) it was 24.5% (N=343) and in children (<15 years) 3.8% (N= 53). Iyengar, (1959) reviewed the literature on the distribution and epidemiology of filariasis in the South Pacific Region and presented abstracts of studies from 1785 to 1959. Iyengar 1960 added additional survey data to that reported Iyengar (1954), as well as providing mosquito infection data. The number of surveys reported from Vanautu increased to 34, with prevalence ranging from 0% to 75% in surveys with 1 to 732 participants. (excluding one survey with 1 tested, 1 positive).

Fig 2 a,b,c,d. Maps from Iyengar 1954 see annex x . The prevalances of Mf andelephantiasis, as well as limits of periodicity types and vectors were summarized in maps published in Iyengar (1954)

No further studies were conducted until the Pacific Programme to eliminate LF (PacELF) started in 1998. A nationwide PacELF baseline survey of Vanuatu in 51 villages in 1997 to 1998 found the Mf prevalence to be 2.5% (N=4569) and ICT prevalence to be 4.8% (N=4362) (see further below).

2.2 Evidence for the absence of LF transmission in areas considered to be nonendemic.

All of Vanuatu was considered endemic.

2.3 A description of filarial disease, including geographical distribution, prevalence and treatment for its various clinical manifestations.

The prevalence of filarial disease up until 1959 was presented in the report of Iyengar (1960). Data on elephantiasis were reported from 52 sites, with prevalence ranging from 0 to 25%, but with half the sites having no cases observed.

No specific treatment was offered for elephantiasis and morbidity until the onset of PacELF.

3. Interventions

3.1 A detailed description of all measures to control or interrupt transmission in each focus.

CONTROL MEASURES PRIOR TO PACELF

Prior to PacELF, there were no specific interventions for lymphatic filariasis. However, since the same vector transmits malaria, the extensive DDT indoor residual spraying that occurred up to the 1980s, followed by bednet distribution campaigns, would have also affected the transmission of LF.

A total of 121,654 ITNS were distributed between 1988 and 2001, representing almost 1 net to 2 persons (WHO et al 2001)

BASELINE SURVEY

For intervention, the whole of Vanuatu is regarded as one implementation unit. In **1998** the country conducted a baseline survey throughout the six provinces using convenience sampling of persons of all ages residing in 51 villages . There were 4 villages on 3 islands in Torba, 7 villages on one island in Sanma, 8 villages on 3 islands in Penama, 8 villages on 3 islands in Malampa, 14 villages on 4 islands in Shefa, and 10 villages on 2 islands in Tafea provinces.

A total of 4,362 blood samples from 48 villages were tested with ICT, giving national antigenaemia prevalence of 4.8% (Table 3). Meanwhile a total of 4,269 Mf blood slides were collected at night from 49 villages, giving 2.5% national Mf prevalence (Table 3). The number of persons tested per village ranged from 1 to 510 by ICT and from 20 to 200 by slide.

All ICT and Mf positive cases were treated with DEC + albendazole. ICT positives were treated after the Mf blood slides were taken at night. Overall, 3.1% of the population were tested, ranging from 1.0% of Torba population to 4.2% of Tafea. (Vanuatu National Filariasis Control Programme, Filariasis Screening Survey in Vanautu Sept 1997-1998)

Penama province had the highest ICT prevalence with 15.0% (N= 784), followed by Torba province with 10.2% (N=227), then Malampa province at 7.1% (N=894) and Tafea 2.5% (N=952). Shefa and Sanma provinces had low levels of ICT positivies: 0.1% (N=640) and 0.3% (N=833) respectively. The prevalence of Mf was generally 2 to 3 times lower than ICT (Table 3). The age groups 0-4 and 5-9 were underrepresented in the sample compared to the population distribution. The highest prevalence of Mf and ICT was observed in the over 50 year olds. The island of Ambae (Penama province) had the highest ICT prevalence of 18% (N=311). Males had a higher ICT prevalence overall than females: 5.8% in males and 3.9% in females.

Table 3. Baseline survey (1997-1998): Convenience sampling in 51 villages

Province	2009 Census Pop	Number of ICT samples	Number of ICT samples positive	% of ICTs positive	Number of Mf samples	Number of Mf samples positive	% of Mf positive
Torba	9,359	59	6	10.2%	227	7	3.1%
Sanma	45,855	370	1	0.3%	833	2	0.2%
Penama	30,819	776	116	14.9%	723	57	7.9%
Malampa	36,724	846	60	7.1%	894	32	3.6%
Shefa	78,723	1,363	2	0.1%	640	1	0.2%
Tafea	32,540	948	24	2.5%	952	7	0.7%
TOTAL	**234,023**	**4,362**	**209**	**4.8%**	**4,269**	**106**	**2.5%**

MASS DRUG ADMINSTRATION, NATIONWIDE 2000-2004

Mass drug administration was carried out once per year from 2000 to 2004 using a community based approach with directly observed treatment using DEC (6mg per body weight) and albendazole (400mg per person). Household registers (Fig 3) were developed and used to track the MDA coverage when books were returned to the national office.

Coverage for each round was reportedly above 75% of total population, using 1999 census data adjusted by estimated population growth for total population data (Table 4).

ADDITIONAL MASS DRUG ADMINSTRATION, MALAMPA PROVINCE, 2008-2010

An additional, geographically limited MDA occurred following the results of 2004 spot-check site monitoring (see below Section 4.1) in North Ambrym, Malampa province (1999 census population: 3,899). Follow-up MDA was implemented there in 2008, 2009, and 2010 with coverage rates of 76%, 78%, and 79%. Denominators for these MDA rounds were based on LF programme registers.

Fig 3: Vanuatu LF MDA Registration Book

Table 4. MDA coverage by province, by year (from register book reports)

Province	MDA coverage				
	2000	2001	2002	2003	2004
Torba	80.0%	82.8%	56.2%	86.1%	84.4%
Sanma	77.2%	73.5%	76.2%	80.2%	73.4%
Penama	90.5%	82.6%	78.8%	80.8%	79.1%
Malampa	88.4%	84.5%	85.5%	77.2%	81.0%
Shefa	81.8%	86.7%	78.4%	81.8%	82.1%
Tafea	70.5%	69.1%	72.7%	76.7%	65.7%
AVERAGE	**81.5%**	**80.3%**	**78.2%**	**79.6%**	**75.5%**

Source: the PacELF Way, 2006

3.2 Review of case management for filarial disease.

In order to estimate the burden of morbidity, in 2003 extra pages on morbidity surveillance were inserted into the MDA registration book, requesting the health workers and MDA team leader to report the existing LF cases in their area during the MDA campaign. The outcome of this was a total of 95 reported morbidity cases (Table 5) of which 67% were lymphoedema cases, 24% were hydrocele cases and 7% were mixed lymphoedema and hydrocele together. Men were twice as likely to be affected as women, and the majority of the cases were found in Penama province.

Since 2003, at any opportunity for the survey team to visit the area and the reported cases, morbidity kits have been provided for the team to take with them. The team trained the family members of the LF patients and the health workers in the area on how to assist the LF patients to care for the affected part on daily basis and during the acute attacks. National program did conduct several training with health workers on home care with LF patients in 2003, 2005 but there is no regular monitoring on the community care programs with the LF patiens.

Table 5: Morbidity data, 2003

Province	Island	No cases	M	F	Body part affected					
					Leg	Arm	Hydro -coele	Breast	Mixed	Un-known
TORBA	Ureparapara	1	1				1			
	Vanualava	1	1		1					
	Total TORBA	***2***	***2***	***0***	***1***	***0***	***1***	***0***	***0***	***0***
SANMA	Santo	15	8	7	8	1	2		4	
	Total SANMA	***15***	***8***	***7***	***8***	***1***	***2***	***0***	***4***	***0***
PENAMA	Ambae	8	6	2	5		2	1		
	Maewo	7	5	2	6		1			
	Pentecost	37	18	19	26	2	6	1	2	
	Total PENAMA	***52***	***29***	***23***	***37***	***2***	***9***	***2***	***2***	***0***
MALAMPA	Ambrym	9	7	2	6		2	1		
	Malekula	2	2			1	1			
	Total MALAMPA	***11***	***9***	***2***	***6***	***1***	***3***	***1***	***0***	***0***
SHEFA	Epi	4	2	2	1	1	1		1	
	Tongoa	3	2	1	1		2			
	Total SHEFA	***7***	***4***	***3***	***2***	***1***	***3***	***0***	***1***	***0***
TAFEA	Tanna	3	3	0	1		1			1
	Erromango	5	5	0	1		4			
	Total TAFEA	***8***	***8***	***0***	***2***		***5***	***0***	***0***	***1***
VANUATU TOTAL		**95**	**60**	**35**	**56**	**5**	**23**	**3**	**7**	**1**

4. Assessment of interventions

4.1 A detailed description of surveys and studies conducted to evaluate the impact of the interventions.

SENTINEL SITES:

Eight sentinel sites were selected from the villages included in the baseline survey. The two villages that had the highest ICT (antigenemia) prevalence in the baseline survey (Table 3) were selected from each of Torba, Penama, Malampa and Tafea provinces. Shefa and Sanma provinces had very low prevalence at baseline, and did not have sentinel sites; they were followed up through hospital laboratories (see below).

The 8 sentinel sites in the four provinces with highest prevalence were surveyed at baseline in 1998-1999 and again in 2002 (8 villages) and 2003 (two villages). Table 6 shows the prevalence in these villages, in all age groups, for all time points.

The overall prevalence in the 8 sites in 1998-1999 was 22% ICT and 11% Mf (N= 561). In 2002, after 2 MDA rounds, sentinel site monitoring of 1,171 persons of all ages in the 8 villages found 8% antigen positivity and 0.8% microfilaremia positivity (Table 6). Thus there was a significant decrease between 1998 and 2002 (Fraser et al, 2005).

Some of the villages were re-tested in 2011 and showed further decrease (Table 6).

Table 6: Sentinel site data, all ages, 1998-1999, 2002 and 2011.

Province	Village	1998-1999			2002			2011		
		ICT % pos	Mf % pos	N	ICT % pos	Mf % pos	N	ICT % pos	Mf % pos	N
Torba	Sola	9.7	3.2	ICT 30 Mf 31	1.2	0.0	165	0	0	4
	Mosina	10.7	7.1	28	4.0	0 .0	76	0	0	5
Sanma	*Not Done*									
Penama	Sakau	45.8	29.1	48	27.2	1.1	92	8.7	0	23
	Wanur	36.1	21.0	61	8.6	1.7	58	0	0	17
Malampa	Orap	4.0	2.0	100	1.3	0.0	224	0	0	4
	Unmet	52.0	28.0	100	21.6	3.4	208	0	0	49
Shefa	*Not Done*									
Tafea	Port Resolution	8.7	2.4	127	1.3	0.0	300	Not Done		
	South River	13.6	6.1	66	11.4	0.0	44	Not Done		
Vanuatu total		**22.5**	**11.9**	**561**	**7.9**	**0.8**	**1171**	**2.0**	**0**	**102**

HOSPITAL SURVEILLANCE

For Shefa and Sanma provinces, there were no sentinel sites: tests were conducted in suspected malaria cases attending the outpatient departments of the provincial hospital over a one month period in 2003 (Table 7). No positives were detected at Vila Central hospital but in Santo, 4.1% of 73 tested was positive. Samples were also tested at Lolowai hospital (Penama province) and Norsup hospital (Malampa province). The results indicated still high prevalence in patients attending both hospitals at that time.

Table 7: Sentinel surveillance in hospital labs, 2003

Province	Site	ICT % pos	N
Torba	Not Done		
Sanma	Santo Northern District hospital	4.1	73
Penama	Lolowai hospital	7.8	154
Malampa	Norsup Hospital	13.5	74
Shefa	Vila Central Hospital	0.0	89
Tafea	Not Done		

SPOT CHECK SITES

In 2004, spot-check site monitoring in North Ambrym in Malampa province found a 19.2% antigen level in 551 samples from all ages. All ICT positives were treated directly after the microfilaremia blood slides were collected. Based on these results, the programme decided to implement three further rounds of MDA in North Ambrym, as noted above. This MDA started in 2008 and lasted until 2010. Directly after MDA in 2008, a spot-check site assessment found a 2.3% antigen level in 1,368 samples from all ages in North Ambrym. The 32 ICT positive persons ranged in age from 17 to 83 years. No sentinel site testing was done after MDA in 2009 or 2010.

In 2008, spot-check site monitoring found a 2.9% antigen level in 456 samples from all ages in South Pentecost and west Ambae sites in Penama province. Both sites found zero microfilaremia positives among those who tested positive for antigen; all ICT positives were treated directly after microfilaremia blood slides were collected. The 13 ICT positives ranged from 17 to 73 years old. No further MDA was conducted in this area.

4.2 Review of any data collected on the impact of interventions on filarial disease.

Impact of the intervention is determined predominantly from the sentinel site and population based surveys.

Studies of antibodies to LF in children under 10 were conducted during surveys conducted in 2007-2008, the first TAS (CTS) survey (Joseph et al 2011). A total of 3840 children aged 5-6 years were sampled and tested using ICT. No positives were found and therefore no Mf slides were done. Total samples of 3840 was collected on filter paper were brought for testing antibodies at JCU. Results indicated that the prevalence of antibodies (measured by Bm14 ELISA) was lower in Vanuatu (6.0%) than in Samoa (30.7%).

5. Surveillance

5.1 A full review of any surveillance activities undertaken since MDA and other interventions were stopped

In 2005, a population-based survey (a "C" survey under PacELF terminology) was conducted in all age groups to determine whether MDA should be stopped. The country was divided into three evaluation units (EU), comprising

1. TORBA and SANMA provinces
2. PENAMA and MALAMPA provinces
3. SHEFA and TAFEA provinces.

30 clusters were selected in each of these EUs using systematic selection with random start from a list of villages with estimated numbers of households per village. Selection was by probability proportionate to size with village size determined according to number of households.

In the survey, 7580 people were tested by ICT, and 0.2 % of them were positive by ICT (Table 8). Only ICT positive persons were visited at night to take a follow-up blood slide, and of those 13, none were positive.

All of the evaluation units had ICT prevalence of less than 1%, with the highest upper 95% CI in EU 1 (Torba and Sanma) at 0.8%. Therefore it was determined that MDA was no longer needed in any of the EUs or the country.

Table 8. Stopping MDA (C) survey results (2005-2006)

Eval-uation unit	Province	No. ICT pos / No tested	% ICT pos	Upper 95% exact binomial CI	No. Mf pos/ No tested	% Mf pos
1	Torba	4/246	1.6%		0/4	0.0%
	Sanma	0/1015	0.0%		-/0	-
	Total EU 1	**4/1261**	**0.3%**	**0.8%**	**0/4**	**0.0%**
2	Penama	9/2592	0.3%		0/9	0.0%
	Malampa	0/1529	0.0%		-/0	-
	Total EU 2	**9/4121**	**0.2%**	**0.4%**	**0/9**	**0.0%**
3	Shefa	0/1109	0.0%		-/0	-
	Tafea	0/1089	0.0%		-/0	-
	Total EU 3	**0/2198**	**0.0%**	**0.1%**	**-/0**	-
VANUATU TOTAL		**13/7580**	**0.2%**	**0.3%**	**0/13**	**0.0%**

Data source: MoH, Vanuatu (C survey report and original data file)

5.2 Review of data collected through post-MDA surveys, such as the TAS.

CHILD TRANSMISSION SURVEY 1 (TAS 1), 2007-2008

A post-MDA survey TAS survey 2 ('D' or child transmission survey in PacELF terminology) was implemented in 2007-2008 in the three EUs (six provinces). It tested 72% of all six- and seven-year-old children in all six provinces in the country, through a community-based approach. No antigen positives were found among the 4,752 samples (Table 8).

Table 8. TAS 1: Post-MDA (Child transmission survey or D) survey I (2007-2008)

Evaluation Unit	Province	Province 6-7 year old pop*	% of 6-7 yr pop tested	N tested ICT	N ICT pos	% ICT pos	Upper 95% exact binomial CI
1	Torba	355	77.2%	274	0	0.0%	
	Sanma	1305	73.6%	960	0	0.0%	
	TOTAL EU 1	**1660**		**1234**	**0**	**0.0%**	**0.2%**
2	Penama	966	52.3%	505	0	0.0%	
	Malampa	1128	86.2%	972	0	0.0%	
	TOTAL EU 2	**2094**		**1477**	**0**	**0.0%**	**0.2%**
3	Shefa	1711	86.1%	1473	0	0.0%	
	Tafea	1140	49.8%	568	0	0.0%	
	TOTAL EU 3	**2851**		**2041**	**0**	**0.0%**	**0.1%**
VANUATU TOTAL		**6605**	**71.9%**	**4752**	**0**	**0.0%**	**0.1%**

* projected from 1999 census

Data source: MoH, Vanuatu (D survey report and original data file)

CHILD TRANSMISSION SURVEY 2 (TAS 3), 2010-2012.TAS 3 was conducted in five stages, described below. Results are shown in Table 9. Note that Penama province was surveyed twice, in both 2010 and 2012 in TAS 3(as part of an operational research project).

TAS 3, stage 1, **2010**: Target: all 6-7 year old children in TORBA, SANMA AND MALAMPA provinces (EU1 and part of EU2). Tested six- and seven-year old children in through a community-based approach. No antigen positives were found. Only 19.2% of children in Torba were tested, but more than the target number were tested in Sanma and 53.3% in Malampa.

TAS 3, stage 2, 2010: Target: children age 6-7 in one baseline survey village in each of SHEFA (Ebule village) and TAFEA (Port Resolution village) (EU3) , community based approach.141 six- and seven-year old children from the villages included in baseline mapping were tested in Shefa and Tafea provinces. No antigen positives were found. Only 5% of Shefa population and 4.2% of Tafea were covered in this stage.

TAS 3, stage 3, 2010: Implemented by the Task Force for Global Health as part of their operational research in primary school level 1 and 2 children in Penama (part of EU2), using a school-based cluster approach. 63 primary schools (every primary school in Penama province). No antigen positives were found among the 930 samples (89.9% of estimated target population).

TAS 3, stage 4, 2012:, Implemented (repeat) by the Task Force for Global Health as part of their operational research in primary school level 1 and 2 children in Penama (part of EU2),, using a school-based cluster approach. 63 primary schools (every primary school in Penama province). Two antigen positives were found among the 933 children tested (90.2% of the target population). Both were followed up for Mf testing and were negative.

TAS 3, stage 5, 2012: In Shefa and Tafea provinces (EU3), a total of 1201 children 6-7 years old were registered and 1106 children were tested from 52 primary schools and 95 children were absent during the survey. In Shefa a total of 653 children of class 1 were tested (35.7% of the target) and zero ICT positives were found. In Tafea province, 453 children were tested (37.1% of the total) and zero ICT positives were found.

Overall the three EUs all passed the TAS 3 (Table 9).

Table 9. TAS 3: Post-MDA (Child transmission survey or D) survey 2 (2010 and 2012)

Evaluation Unit	Province	Province 6-7 year old pop*	% of 6-7 yr pop tested	N tested ICT	N ICT pos	% ICT pos	Upper 95% exact binomial CI
1	Torba Stage 1 (2010)	380	19.2%	73	0	0.0%	
	Sanma Stage 1 (2010)	1397	113.6%	1587	0	0.0%	
	TOTAL EU 1	**1777**	**93.4%**	**1660**	**0**	**0.0%**	**0.2%**
2	Penama Stage 3 (2010)	1034	89.9%	930	0	0.0%	
	Penama Stage 4 (2012)	1034	90.2%	933	2**	0.2%	
	Malampa Stage 1 (2010)	1207	53.3%	643	0	0.0%	
	TOTAL EU 2	**2241 *****	**70.3% *****	**2506**	**2**	**0.07%**	**0.3%**
3	Shefa Stage 2 (2010)	1831	5.0%	91	0	0.0%	
	Shefa Stage 5 (2012)		35.7%	653	0	0.0%	
	Tafea Stage 2 (2010)	1,220	4.1%	50	0	0.0%	
	Tafea Stage 5 (2012)		37.1%	453	0	0.0%	
	TOTAL EU 3	**3051**		**1247**	**0**	**0/0%**	**0.2%**

* projected from 1999 census; ** both were Mf negative; *** counting Penama population only once and taking average of % tested from the two repeats

Data source: MoH, Vanuatu (2010 and 2012 survey reports, Task Force and original data file)

5.3 Review of the filariasis case reports through routine disease surveillance or other systems for case detection.

Surveillance is ongoing in Sanma and Shefa provinces, where all suspected malaria patients reporting to the two main hospitals are also tested for LF antigenemia using ICTs. As of December 2011, 1100 samples had been tested, with 0 LF-antigen positives found.

5.4 Evidence that adequate sampling or surveillance was conducted in all previously endemic areas and in areas that were defined as non-endemic during initial mapping.

Not applicable since all areas were included in the programme.

5.5 Details on surveys done in cross-border areas and in immigrants from filariasis-endemic areas

All new students from Pacific Island countries at the University of the South Pacific were tested by ICT in February 2011, with 0 positives of 101 sampled.

5.6 Demonstration that any positive cases detected following MDA represented isolated events not traceable to an area of active transmission. If an area of potential transmission was discovered, evidence should be presented that subsequent interventions (e.g. MDA) were successful.Positive cases were identified in Malampa and Penama provinces at the end of the MDA period. These cases were all treated. 3 more rounds of MDA were conducted in part of Malampa (North Ambrym).

There were 2 ICT positive children identified in the TAS 2 survey (2012) in Penama. However the prevalence of 0.07%(upper 95% CI 0.3%) in 6-7 year olds children is below the threshold for indicating ongoing transmission.

6. Additional data that support the absence of LF transmission

SOIL TRANSMITTED HELMINTH SURVEYS

Stool surveys for intestinal parasites: hookworm, *Ascaris lumbricoides* and *Trichuris trichiura* were conducted in children aged 6-16 on Efate island in 2002, before and after the third round of LF MDA, partly as a means of assessing the impact of LF MDA. . The prevalence of soil transmitted helminths decreased by 66% after the survey compared to before (N=55).

MALARIA INCIDENCE AND NET COVERAGE

LF and malaria are transmitted by the same mosquito vector in Vanuatu (*An. farauti)*. The Malaria Control Programme in Vanuatu targeted universal long-lasting bednet distribution coverage by 2011. National LLN net coverage (percent of persons potentially covered by a net, estimated from net distribution numbers and assumptions about net durability with a 3 year net life) was 61% in 2010 and 100% in 2011. In 2009-2011, three rounds of indoor residual spraying (IRS) occurred in the entire province of Tafea (which is working towards malaria elimination) with 95% of households being sprayed. In 2011, IRS occurred in one of the high-risk malaria areas in Shefa province with 92% of 1040 households being sprayed; however, this is not the LF high-risk area included in baseline LF mapping. One round of spraying has also been conducted in Torba province in 2012.

The malaria annual parasite incidence has declined from 2009 to 2012 and is now at 13 per 1000 per year with 60-70% of cases being *P.vivax*.

7. Acknowledgements

The Ministry of Health Vanuatu would like to thank Dr Patricia Graves of James Cook University, for her technical inputs and help with the initial draft of the dossier. The MoH is grateful to all partners, both past and current in particular, JICA, US-CDC, Korean CDC and GSK, that supported the LF elimination program in Vanuatu in various ways, Technical assistance received from staff of the WHO country office, Division of Pacific Technical Support and regional office in Manila and WPR NTD Regional Program Review Group is gratefully acknowledged.

8. Bibliography

Abe M, Yaviong J, Taleo G, Ichimori K. 2003. **Microfilarial periodicity of Wuchereria bancrofti in the Pacific.** *Trans Roy Soc Trop Med Hyg*.. 97(5) 498-500.

AusAID, 2009. **Annual review of development effectiveness: Improving basic services for the poor**. http://www.ode.ausaid.gov.au/publications/pdf/arde2009.pdf

Belkin J N, 1963. **The Mosquitoes of the South Pacific, vol.1-2.** California: University of California Press.

Byrd EE, St Amant LS, 1959. SPC technical paper no 125. **Studies on the epidemiology of filariasis on central and south Pacific islands.** South Pacific Commission: Noumea, New Caledonia.

Fraser M, Taleo G, Taleo F, Yaviong J, Amos M, Babu M, Kalkoa M. 2005. **Evaluation of the program to eliminate lymphatic filariasis in Vanuatu following two years of mass drug administration implementation: results and methodological approach**. *Am J Trop Med Hyg* 73: 753-758.

Government of Vanuatu, Annual Development Report, 2009. Port Vila, Vanuatu.

Huppatz C, Capuano C, Palmer K, Kelly PM, Durrheim D, 2009. **Lessons from the Pacific**

programme to eliminate lymphatic filariasis: a case study of 5 countries. *BMC Inf Dis* 9:92.

Iyengar MOT, 1954. SPC Technical paper No 66. **Distribution of filariasis in the South Pacific Region.** South Pacific Commission; Noumea, New Caledonia.

Iyengar MOT, 1956. SPC Technical paper no 88. **Annotated bibliography of filariasis and elephantiasis, Part 2: studies on mosquitoes of the South Pacific Region.** South Pacific Commission: Noumea, New Caledonia.

Iyengar MOT, 1959. SPC Technical paper no 126. **A review of the literature on the distribution and epidemiology of filariasis in the South Pacific Region.** South Pacific Commission: Noumea, New Caledonia.

Iyengar 1960. SPC Technical paper No 132. **Summary data on filariasis in the South Pacific.** South Pacific Commission: Noumea, New Caledonia.

Joseph H, Maiava F, Naseri T, Taleo F, 'Ake M, Capuano C, Melrose W. 2011 **Application of the filariasis CELISA antifilarial IgG4 antibody assay in surveillance in lymphatic filariasis elimination programmes in the South Pacific**. *J Trop Med* 2011; 492023.

Lum On M, Bennett V, Whittaker, M , 2010. **Health information systems in the Pacific: a case study of Vanuatu**. Health information systems knowledge hub. Documentation note series, number 3, Nov 2009. www.uq.edu.au/hishub

National Statistics Office, Vanautu. 2009. **National Census of Population and Housing.** Summary release, Ministry of Finance and Economic Management, Port Vila, Vanuatu.

Ree H, Mape J & Yaviong J. (1991). **Study on Anopheles farauti in the Republic of Vanuatu**. Yonsei Reports on Tropical Medicine, 22, 43-44.

Sasa, M. (1976). **Human Filariasis: a Global Survey of Epidemiology and Control**. Tokyo: University of Tokyo

SPC, 1954. SPC Technical paper no 65. **An annotated bibliography of filariasis and elephantiasis: Part 1: Epidemiology of Filariasis in the South Pacific Region**. South Pacific Commission: Noumea, New Caledonia.

Webber RH (1975) **Vector control of filariasis in the Solomon Islands.** *Southeast Asian J Trop Med Public Health* 1975, **6:**430-434.

WHO/Rotary Club/AusAID/UNICEF/Japan Govt/Japan Junior Chamber report on Vanuatu Insecticide Impregnated Mosquito Bed Net Project for Malaria Control, Annual Donors report 2001; Port Vila; Mar 2002

WHO 2005. **Monitoring and epidemiological assessment of the programme to eliminate lymphatic filariasis at implementation unit level.** 2005.

WHO 2006. **The PacELF Way: Towards the elimination of lymphatic filariasis from the Pacific, 1999-2005**. Manila: WHO Western Pacific Region; 2006.

WHO 2008. **Report of the ninth workshop for pacific lymphatic filariasis programme managers.** Available: http://www2.wpro.who.int/NR/rdonlyres/68 DCB443-20CD-4E7E-96F5 0FB73092123C/0/MR_ (correct this link)

WHO 2010. **Global Programme to Eliminate Lymphatic Filariasis. Progress Report 2000-2009 and Strategic Plan 2010-2020.** pp. WHO/HTM/NTD/PCT/2010.2016. Geneva

WHO 2011: **Global Programme to Eliminate Lymphatic Filariasis. Monitoring and Epidemiological Assessment of Mass Drug Administration.** Geneva: World Health Organization; 2011.

WHO 2011. **Regional Programme Managers Meeting on Lymphatic Filariasis and Other Selected Neglected Tropical Diseases.** Manila, Philippines: WHO Western Pacific Region; 2011.