

Original article

Prevalence of Lymphatic Filariasis from 1999 through 2007 in Nauru, a Set of Solitary Island in the Southern Pacific

Emi Sasagawa

Received 30 January, 2009 Accepted 11 May, 2009 Published online 12 June, 2009

Abstract: As part of the Pacific Program to Eliminate Lymphatic Filariasis (PacELF), baseline surveys were conducted in 1999 and 2004 in Nauru to determine the prevalence of filariasis by rapid immunochromatographic test (ICT). In 1999, the survey demonstrated a filariasis prevalence of 0.26%, and Nauru was classified as a non-endemic country at the time. In 2004, the prevalence resulting from the survey was 1.66%. Since it exceeded 1.0%, this high prevalence warranted the implementation of Mass Drug Administration (MDA) according to WHO guidelines and gave rise to an urgent need to re-establish the filariasis policy in Nauru, as the target year for filariasis elimination in the Pacific is 2010. The present study was conducted to determine the current prevalence of filariasis, to decide whether implementation of the MDA program is necessary, and to compare the demographic characteristics of participants according to the ICT test results. Blood sampling and interviews, based on a simple questionnaire asking about filariasis-related symptoms, were conducted by trained health staff members. A total of 1,513 people were enrolled for the survey in January 2007. Filariasis positivity was detected in three subjects (0.2%) by ICT test. Nauru was reconfirmed as a non-endemic country and therefore did not require the MDA implementation. The prevalence did not vary significantly according to the demographic characteristics. The three seropositive cases did not have any filariasis-related symptoms. However, two of the three positive cases of filariasis lived in the same district and the other lived in a neighboring district. To assess the interruption of filariasis transmission, further surveys are recommended.

Keywords: Lymphatic filariasis, Nauru, PacELF, MDA, ICT

INTRODUCTION

Lymphatic filariasis is recognized as a serious public health concern in view of its huge adverse effect on clinical morbidity and disability [1, 2, 3]. Consequently, global efforts are underway to eliminate lymphatic filariasis. The Pacific Program to Eliminate Lymphatic Filariasis (PacELF) was established in 1999 to eliminate filariasis in the Pacific region by 2010 through Mass Drug Administration (MDA). The primary strategy for the prevention of filariasis, MDA is based on providing anti-parasite drugs once a year for five years to the entire population at risk of developing filariasis. This strategy has contributed to a significant reduction of cases.

Nauru has been involved in two baseline surveys, one performed in 1999 and the other in 2004 by immunochromatographic test (ICT) (Table 1) [4]. The 1999 survey in-

involved 388 participants and detected one positive case (prevalence of 0.26%). Nauru was subsequently classified as a non-endemic country (PacELF, 2006; PacELF, 2004). The 2004 survey involved 902 participants and detected 15 positive cases (prevalence of 1.66%). Since it exceeded 1.0%, this prevalence warranted the implementation of MDA according to the WHO guidelines for Filariasis Elimination. Moreover, six of the 15 positive cases (40%) were

Target area	Year Conducted	No. examined	No. positive	Prevalence (%)
Nationwide	1999	388	1	0.26
Nationwide	2004	902	15	1.66
Nationwide (current study)	2007	1,513	3	0.20

Corresponding author:

Chagas Disease Control Project Phase 2, El Salvador Japan International Cooperation Agency, Apartado Postal No. 01-114, San Salvador, El Salvador, C. A.

Tel: 503-2221-6204

Fax: 503-2221-6204

E-mail: ebodo77@yahoo.co.jp

from one district (the Nibok district) [4].

This sudden increase from 1999 to 2004 indicated the occurrence of an endemic in limited districts of Nauru. Experiences in the hospital and communities, including the number of patients observed with elephantiasis, hydrocele and cellulitis, also suggested the existence of filariasis in Nauru. However, the blood samples used in the latter survey were collected, not for the filariasis baseline survey, but for surveillance of other non-communicable diseases and involved about 2,000 participants ranging in age from 15 to 64 years. Therefore, the filariasis baseline survey of 2004 contained uncertainty in measurement procedures, e.g., it was not known how the 902 subjects for the ICT test were selected from among the 2,000 participants in the non-communicable disease surveillance. The study presented here was carried out in 2007 to determine the prevalence of filariasis in Nauru, to decide whether implementation of the MDA program was necessary, and to compare the characteristics of participants according to the ICT test results.

STUDY AREA AND TEST METHODS

The study was undertaken as a nationwide program over a period of three weeks in January 2007. Nauru is an island located at S0 32 E166 55, approximately 41 km south of the equator, having a land area of 21 km² with 9,275 inhabitants as of 2006. Nauru consists of 15 districts: Yaren, Boe, Buada, Aiwo, Denigomodu (Denig), Location, Nibok, Uaboe, Baitsi, Ewa, Anetan, Anabar, Ijuw, Anibare and Menen.

Blood sampling by the rapid immunochromatographic test for the detection of *Wuchereria bancrofti* antigen (ICT, Lot No. 023766, 023767, Binax Inc, USA) was performed and interpreted according to the manufacturer's instructions. Blood samples were taken by finger prick blood collection using a capillary. All ICT cards were assessed by trained health personnel exactly 10 minutes after samples were taken.

Questionnaires were designed so that the characteristics and trends of filariasis in Nauru could be compared between ICT negative and positive cases. The following types of data were collected by closed-end questions: (1) Demographic data, including sex, nationality, and age; and (2) participants' filariasis-related symptom data including existence of slight leg swelling, enlarged leg with folds, enlarged arm, enlarged breast, hydrocele, cellulitis, and recurrent cellulitis. Visual aids illustrating filariasis-related symptoms were utilized. However, visual inspection and clinical evaluation of symptoms were not achieved. Data collection was conducted by health personnel who underwent interviewer training for two days. The training mate-

rial covered the biology and pathology of filariasis, related symptoms, survey methodology and procedure.

Sample size estimation was calculated and showed that at least 1,323 participants were required for the survey to obtain accurate results. A total of 1,500 samples were selected randomly by the Bureau of Statistics Office based on the database of the Household Income and Expenditure Survey in 2006 among a population of 9,275. Demographic data such as age and the population size of each district was taken into account for random sampling. Ultimately, 16.2% of the population was extracted as a sample from each district.

The criteria for participation in the study were residence in Nauru, age four years or over, and any ethnicity. ICT positive cases from previous studies were eligible for inclusion in this study. The only exclusion criteria were infants aged zero to three years. International organization representatives from foreign countries, mainly Australia, were also excluded from participation. In cases where participant numbers were insufficient, voluntary participants were accepted until the required sample number was achieved, as long as these volunteers met the selection criteria. Recruitment and appointment of participants was performed one day before the scheduled survey date for each district. On the following day, data collection was conducted at survey sites, as well as the dwellings of participants.

To ensure quality and completeness, the data was double checked at two stages. At the first stage, questionnaires were checked by the interviewers themselves, confirming that all coding boxes for each question were filled in completely. At the second stage, the project coordinator checked all the questionnaires and assigned serial numbers. Data were entered into the study database made by EpiData. The statistical analyses were performed with the statistical package SPSS 11.5 J for Windows.

Informed consent was obtained from the participants in the appointment process, but informed consent was not obtained from voluntary participants who came to the survey site directly without appointment. However, in all cases, special care was taken to keep private information confidential.

RESULTS

A total of 1,513 subjects, composed of 819 randomly selected participants (54.6% of randomly selected people and 54.1% of the examined subjects) and 694 voluntary participants (45.9% of the examined subjects), were tested with rapid diagnostic test kits (ICT) during the survey period (Figure 1). Participants were made up of 736 males

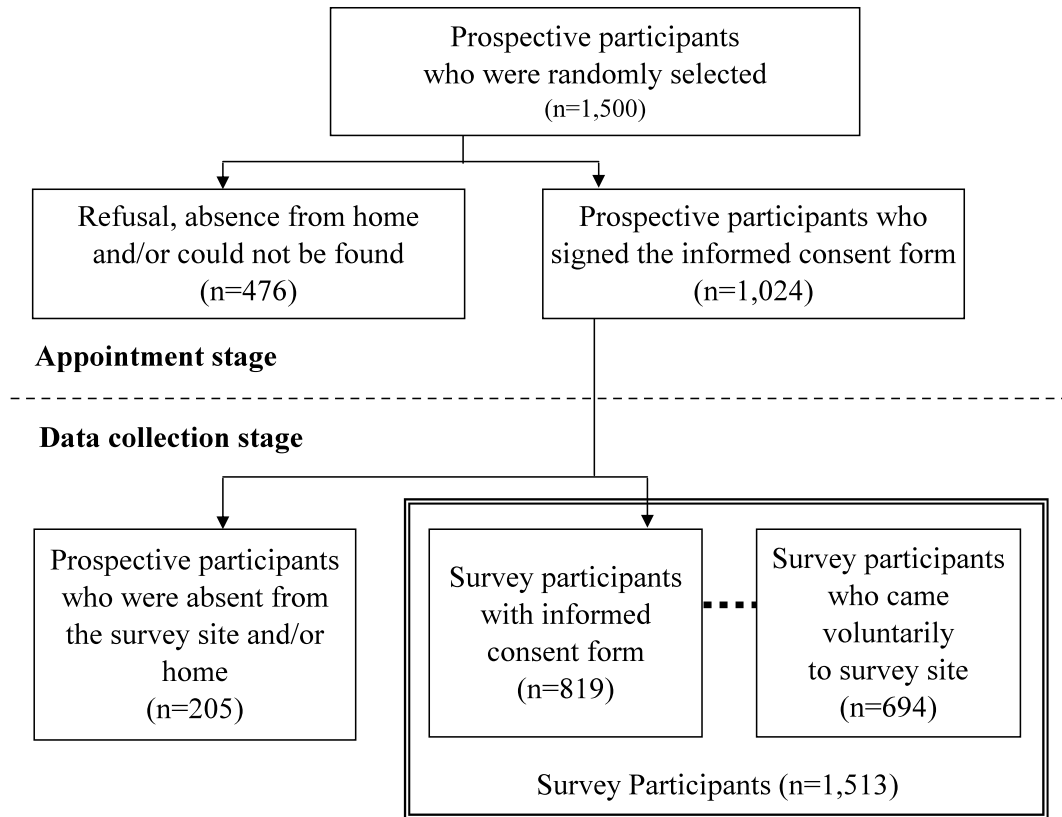


Figure 1. Number of participants and recruitment flowchart

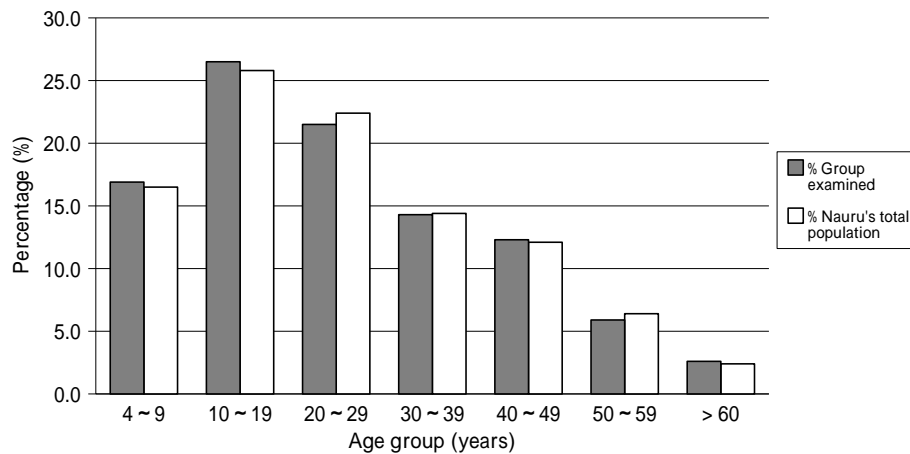


Figure 2. Comparison of the age distribution (%) between the examined subjects and Nauru's total population

(48.6%) and 777 females (51.4%). Nationality was 1,459 Nauruan (96.4%), 44 Gilbertese (2.9%), and 10 other nationalities (0.7%). To assess the representativeness of participants, the percentage of age distribution (Figure 2) and the percentage of area structure (Figure 3) between the examined subjects and total population of Nauru were compared, and the examined group in the current study was

found to be representative of Nauru's total population.

Among the 1,513 examined subjects, filariasis positive cases were detected in three persons (0.2%). Table 2 briefly explains the information of each case, and Figure 4 shows the district of residence. Specimens from the three ICT positive cases were sent to the contract laboratory in Australia for microfilaria confirmation by microscopy, and the re-

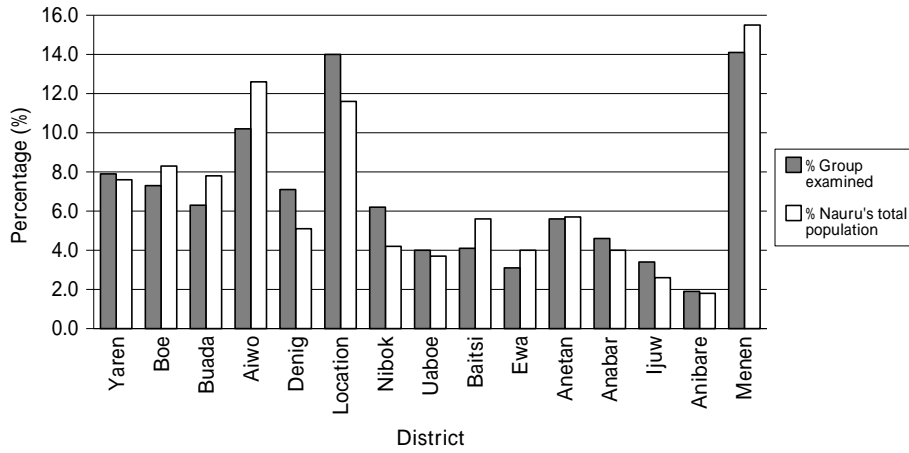


Figure 3. Comparison of the area structure (%) between the examined subjects and Nauru's total population

Table 2. Information on the three ICT positive cases

No.	Sex	Age	District	Nationality	Micrfofilaria	Filariasis related symptoms
1	M	23	Boe	Nauruan	Negative	None
2	F	10	Boe	Nauruan	Negative	None
3	F	40	Aiwo	Nauruan	Negative	None

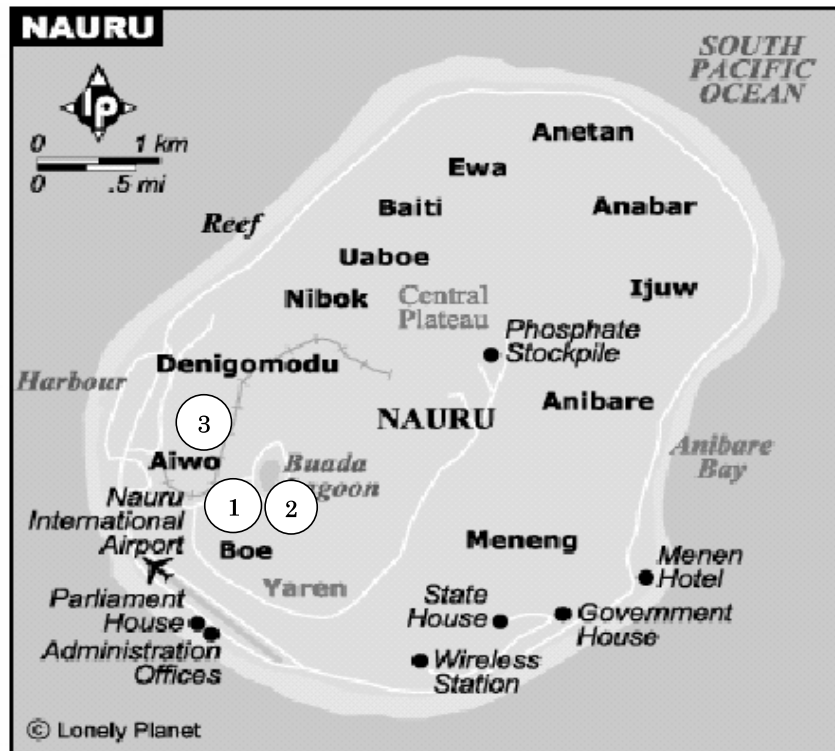


Figure 4. Geographical distribution of ICT positive cases

sults were negative. These three ICT positive cases were voluntary participants. Two of the positive cases reside in Boe, their domiciles located within 400 m of each other. The third subject lives in Aiwo, which is adjacent to Boe.

Point prevalence of ICT positivity for all participants was 0.20% (95% CI of 0.03 to 0.42). The demographic characteristics were compared between the ICT negative cases (1,510 persons) and the three positive cases (Table 3).

There were no significant differences between the two groups with regard to sex ($p=0.595$), nationality ($p=0.739$), or age ($p=0.911$). To simplify the analysis, the 15 districts were grouped into five regions following the national census classification based on the geographical distribution, and, again, prevalence did not differ significantly according to the resident districts ($p=0.180$).

Among the examined subjects, there were 56 (3.7%) with leg swelling, 11 (0.7%) with enlarged leg, 19 (1.3%) with arm swelling, 67 (4.4%) with cellulitis, and 263 (17.4%) with recurrent cellulitis. Among females, there were 13 (1.7%) with enlarged breast. Among males, there were 11 (1.5%) with hydrocele. The three seropositive cases did not have any filariasis-related symptoms.

Table 3. Distribution of demographic characteristics among ICT negative and positive cases

		No. ICT test negative	No. ICT test positive	No. examined	
Total		1,510	3	1,513	
Demographics					
Sex	Male	735	1	736	
	Female	775	2	777	
Nationality	Nauruan	1,456	3	1,459	
	Others	54	0	54	
Age	4-19	655	1	656	
	20-39	541	1	542	
	40-59	274	1	275	
	≥60	40	0	40	
District	Yaren	120	0	120	
	Boe	108	2	110	
	Buada	96	0	96	
	Aiwo	154	1	155	
	Denig	108	0	108	
	Location		212	0	212
	Nibok		94	0	94
	Uaboe		60	0	60
	Baitsi		62	0	62
	Ewa		47	0	47
	Anetan		85	0	85
	Anabar		70	0	70
	Ijuw		51	0	51
	Anibare		29	0	29
	Menen		214	0	214

DISCUSSION

The Ministry of Health of Nauru carried out a filariasis baseline survey as a nationwide program, using ICT test for filarial antigen detection and a simple questionnaire. The current study revealed that the filariasis prevalence was 0.20%, reconfirming Nauru as a non-endemic country. This prevalence can serve as the guiding principle for Nauru's filariasis policy in that it indicates no need to implement MDA in this case. However, Nauru still has concerns and potential causes of a filarial pandemic due to crowded living conditions, housing quality, and inadequate waste disposal management. Also, frequent migration between endemic countries such as Fiji, Kiribati, and the Marshall Islands can contribute to filariasis occurrence. Therefore, the Ministry of Health should closely monitor the incidence of filariasis in order to maintain the filariasis-free status of Nauru.

The prevalence found in this study (0.20%) was similar to that of the 1999 study (0.26%). However, the present study can be considered more accurate in view of the sample size (the 1999 and 2004 surveys included 388 and 902 people, respectively) and the ICT measurement method, because the assessment of results was performed strictly according to the manufacturer's instructions. Nevertheless, sampling bias could not be eliminated, even though the demographic characteristics of the examined subjects and total population were similar. Of 1,513 examined subjects in this survey, 819 (54.1%) were randomly selected participants and 694 (45.9%) were voluntary participants. It is difficult to predict the impact of such a large number of volunteer participants.

The 2004 survey involved 902 participants, with 15 subjects (1.66%) identified as ICT positive cases. The results showed a high incidence of ICT positive cases in the Nibok district (the population of Nibok was 479 people according to the national census in 2002, and number of participants from Nibok in the 2004 survey was 72). Among the 15 ICT positive cases, six persons resided in the Nibok district (40% of all positive cases, 8.3% of participants from Nibok). Two positive cases detected during the 2004 survey were involved in the present study. The ICT results of these two subjects (one was a randomly selected participant and the other a voluntary participant), both of whom took Albendazole and DEC in 2004 and 2005, were negative. ICT results tend to remain positive for some time after effective treatment, probably two or three years, although the exact time frame is not known. Therefore, it is possible that an ICT positive case in 2004, if undergoing the appropriate drug regimen, could turn out to be negative in 2006.

Another interesting observation was the sudden decrease of prevalence in the Nibok district (from 8.3% to

0.0%), given the number of participants from Nibok (94 subjects). The treatment of Albendazole and DEC for the six positive cases from 2004 may have been effective. On the other hand, several interviewers stated that they observed that results often turned positive after more than 10 minutes. Therefore, there was a possibility that the prevalence of the 2004 survey contained a number of false positive cases if some ICT cards were checked after more than 10 minutes.

To assess the trends of filariasis incidence, demographic factors were compared according to the ICT test results. No significant variations were observed between ICT negative and positive cases with regard to any category. Because the ICT positive cases were relatively rare (three persons or 0.20%), it was difficult to assess the trend of filariasis by means of statistic analysis.

Through the survey, some participants having chronic clinical filariasis were detected by questionnaire-based interview. However, it would seem that the data did not reflect accurate levels of filarial burden. This may be due to the fact that the survey was conducted using only a questionnaire-based interview, no clinical observations or evaluations being performed.

Questions regarding the association between filariasis and cellulitis have arisen in the hospital and affected communities, and this survey revealed a high prevalence of recurrent cellulitis (17.4%). However, the causes of cellulitis are not only lymphedema but also insect bite, aging, diabetes, and ulcers or fungal infections. The prevalence of cellulitis in Nauru is likely related to factors such as the high prevalence of diabetes in Nauru (16.2% in 15 to 64 year olds, 45.0% in 55 to 64 year olds) [5]. The current study suggested that cellulitis was very common among the people who exhibited filariasis-related symptoms, but this study could not verify whether cellulitis itself was associated with filariasis.

With regard to filariasis, Nauru was confirmed as a non-endemic country. However, there is a limit to the information available on ICT positive cases and on people who exhibited filariasis-related symptoms. Case studies and clinical inspections on these people as well as further studies in the Boe and Aiwo districts are recommended, since these two districts are adjacent. Moreover, to verify the interruption of filariasis transmission and to obtain national certification for filariasis elimination, further surveys focusing on five to six year old children must be undertaken before the end of the target year 2010.

which is run in collaboration with JICA. The authors thank Dr. K. Keke, Ms. M. Bacigalupo, Dr. L. Hansell, Mr. T. Schweitzer, Dr. C. Capuano, Dr. Y. Kamiya and Dr. Y. Tabaru for their thoughtful advice, as well as the local PacELF team and all staff members of Nauru General Hospital for their contribution to the survey.

REFERENCES

- 1) PacELF, WPRO (2006): The PacELF way, towards the elimination of lymphatic filariasis from the Pacific 1999-2005
- 2) PacELF Home Office (2004): PacELF Hand Book, Facts and methods for lymphatic filariasis elimination in the Pacific, PacELF manual part 1
- 3) GAELF (2002): Report of the second meeting of the Global Alliance to Eliminate Lymphatic Filariasis
- 4) PacELF Home Office (2006): PacELF Data Book 2006, Blood survey and MDA data for all 22 countries and territories in the Pacific
- 5) Ministry of Health of Nauru (2007): Nauru STEPS report 2005, The WHO STEPS wise approach to surveillance of non-communicable diseases (STEPS)

ACKNOWLEDGEMENT

This study formed part of the PacELF project in Nauru,