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Treatment costs and loss of work time to individuals with chronic lymphatic filariasis in rural communities in south India

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Summary This year-round case-control study investigated treatment costs and work time loss to people affected by chronic lymphatic filariasis in two rural communities in south India. About three-quarters of the patients sought treatment for filariasis at least once and 52% of them paid for treatment, incurring a mean annual expenditure of Rs. 72 (US $ 2.1; range Rs. 0–1360 (US $ 39.0)). Doctor's fees and medicines constituted 57% and 23% of treatment costs. The proportion of people seeking treatment was smaller and treatment costs constituted a higher proportion of household income in lower income groups. Most patients did not leave work, but spent only 4.36 ± 3.41 h per day on economic activity compared to 5.25 ± 3.52 h worked by controls; the mean difference of 0.89 ± 4.20 h per day was highly significant ($P < 0.01$). This loss of work time is perpetual, as chronic disease manifestations are mostly irreversible. An estimated 8% of potential male labour input is lost due to the disease. Regression analyses revealed that lymphatic filariasis has a significant effect on work time allotted to economic activity ($P < 0.05$) but not on absenteeism from work ($P > 0.05$). Female patients spent 0.31 ± 1.42 h less on domestic activity compared to their matched controls ($P < 0.05$). The results clearly show that the chronic form of lymphatic filariasis inflicts a considerable economic burden on affected individuals.

keywords lymphatic filariasis, economic, social, disability, rural areas

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Introduction

Lymphatic filariasis, the second leading cause of permanent and long-term disability (WHO 1995), is a major socio-economic problem in many tropical and subtropical countries. It affects 120 million people in 73 countries, nearly one-third of whom live in India (Michael *et al*. 1996). About half of the people with lymphatic filariasis have overt clinical disease manifesting as chronic lymphoedema of the lower limbs (rarely upper limbs) in men and women and hydrocele in men (Manson-Bahr & Bell 1987). These manifestations are mostly irreversible and a cause of socio-psychological problems to patients and often their families.

Chronic lymphatic filariasis causes severe functional impairment and disability (Gyapong *et al*. 1996; Dreyer *et al*. 1997; Ramaiah *et al*. 1997) and loss of productivity (Ramu *et al*. 1996). Data on the economic costs of a disease are necessary to accord appropriate priority to its control. Evans *et al*. (1993) reviewed the social and economic impact of lymphatic filariasis. While treatment costs and loss of labour due to the acute form of lymphatic filariasis have been documented (Ramaiah *et al*. 1998), similar information on chronic filariasis is necessary to assess the overall economic impact of the disease. We investigated the costs of treatment (direct costs) and loss of labour (indirect costs) to individuals affected with chronic lymphatic filariasis caused by infection with *Wuchereria bancrofti*, in a year-long study in rural areas of Tamil Nadu state in south India.

Materials and methods

Study area

The study was conducted in two villages: Chinna Thatchur (CHT) and Avvayarkuppam (AVK) in Villupuram-Ramasamy Padayatchiar (VRP) district in Tamil Nadu state. The villages are located about 60 km from Pondicherry. Epidemiological surveys in the study villages showed microfilaria (mf) rates of

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12.77% and 13.14% and chronic disease rates of 20.28% and 18.18% in CHT and AVK, respectively. In India the rural population has not been protected by any antifilariasis measures. Nutritional disorders and intestinal helminth infections are also common in the study villages. Primary Health centres (PHCs) in neighbouring villages, located about 2–4 km away, are an important source of medical treatment. Villagers also consult local healers for the treatment of minor ailments. People with major ailments approach private medical practitioners practising in nearby towns about 10–15 km away. Buses are the means of transport.

Study design

The study was undertaken during 1993–94. Initially, the team met community leaders to explain the purpose of the study and then conducted a house-to-house census in both study villages. Details on family size and on sex, age, educational status and occupation of each household member were collected, as well as data on the type of house (thatched or tiled/concrete) and possession of certain assets (TV/radio/cycle/fan).

During the census we identified a total of 506 patients with obvious and overt chronic filarial manifestations. From this group a cohort of 75 individuals – male hydrocele or lymphoedema and female lymphoedema patients – was selected following a stratified random sampling method to examine the indirect and direct costs due to the disease. To study the impact of chronic disease on work time of the patients in a case-control design, 75 neighbourhood controls individually matched to patients by age, sex and occupation were also recruited to the study. Control individuals had no history of either acute or chronic filariasis. Direct and indirect cost data were collected simultaneously.

Indirect costs

To estimate the indirect costs of chronic lymphatic filariasis, all 75 patients recruited to the study were visited every three months for one year by a team of two health workers. Data on the activity pattern for both cases and controls during the 24 h prior to the visit of the study team were collected during the quarterly visits. Daily activities were classified into 8 categories: economic, domestic, personal, leisure, travel, social customs, health-seeking and education. Information elicited from patients and controls comprised a chronological list of activities and the time spent on each. If a patient was unavailable during the first visit of the team in a quarter, he or she was not considered during that quarter for the collection of activity pattern data to avoid any change in behaviour or allocation of time to activities. Four visits in a year facilitated collection of data during all the seasons *viz*, summer, rainy and winter. Of the eight activities only the results pertaining to economic and domestic activity are examined here, as they are the most important and productive ones.

Direct costs

Direct costs, including expenditure on doctor's fee, medicines, travel, etc., were also estimated during the above described visits. During each visit the patients were asked the following questions: Did they seek any treatment specifically for chronic filariasis during the last 3 months? If yes, what was the place visited for treatment and the cost of travel and other incidental expenditure? How much was spent on an escort, if any? How much was spent on doctor's fees and medicines? The answers to these questions were elicited mainly by recall. However, when available, the doctor's prescription and medical bills were also examined to compile the expenditure.

Though chronic patients suffer from frequent acute adenolymphangitis episodes (Ramaiah *et al.* 1996a), care was taken to include only the treatment costs and loss of work due to chronic disease under the present study. Direct and indirect costs due to ADL episodes were estimated using a separate study design (Ramaiah *et al.* 1998).

Statistical analysis

Treatment costs varied widely and ranged from Rs.1 to Rs. 1360. Therefore, the mean expenditure is expressed in terms of geometric mean (Ramaiah *et al.* 1998), which was calculated using the logarithmic method. The significance of difference between the proportion of patients who completely lost the day's labour (0 h labour input) and controls was examined using the χ^2 test. Paired t and signed rank tests were applied to test the significance of difference in the time allocated by cases and controls to economic and domestic activity. The effect of the disease on patients' absence from work (taking part in work = 1; not taking part in work at all = 0) and the number of hours worked was examined by using logistic (forward likelyhood ratio method) and multiple regression (forward elimination procedure) analyses, respectively, by including disease status and other variables such as age, occupation, assets, household type and size as independent variables. Regression analyses were done using SPSS/pc + V. 4.0.

Results

Local economy

About 79% of the study population live in thatched houses; the remainder inhabit tiled or concrete houses, which indicate

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better economic status. Weaving and agriculture in CHT and agriculture in AVK were the predominant occupations. Nearly 69% of the families in CHT and 35% in AVK do not own any land; the remaining individuals were either marginal or small farmers. Dry land constitutes nearly 90% of the arable area and crops are rain-dependent. Thus cultivation takes place only during the monsoon and early winter seasons. Employment opportunities within the village are limited, particularly during the summer season. However, weaving and weaving-associated labour continues throughout the year. Daily wages for male agricultural labourers were Rs. 25.00 (US $ 0.71); for females, Rs. 8.00 (US $ 0.23). Weavers earned Rs. 24.00 (US $ 0.69) per day. The average household size was 4.64 ± 1.87 and the average number of working persons per family was 2.64 ± 1.22. Nearly three-quarters (73.7%) of the families have an income of less than Rs. 5000 (US $ 143) *per annum* and only 10% have more than 10000 (US $ 286).

Quarterly visits to patients

Of 75 patients recruited to the study, 64 were available during all the four visits in the year, 8 were available three times and 3 only twice. Controls were visited accordingly. Altogether 286 visits each were made to patients and controls to collect data on activity patterns. To elicit information on treatment costs, those 11 patients who were available only two or three times were visited subsequently to complete the four visits and thus all 75 patients had 4 visits.

Characteristics of patients and controls observed for activity pattern

The 75 chronic patients consisted of 45 males and 30 females. The average age of patients and controls was 40.49 ± 13.86 and 39.95 ± 13.12 years, respectively. Of 75 patients, 46 (16 males and 30 females) had lymphoedema of the lower limbs, 27 had hydrocele and 2 had both. Thirty-four (45.3%) families in each patient and control group possessed certain assets (TV/radio/cycle/fan). Most patients (51/75 = 68%) and controls (50/75 = 67%) lived in thatched houses. The average patient household size was 4.79 ± 1.62; that of controls, 4.67 ± 1.46. Farmers comprised 52% (39/75) of patients and 53% (40/75) of controls. The mean duration of chronic disease was 9.97 ± 9.17 years.

Sources of treatment

All people affected by lymphoedema of the lower limbs and more than 80% with hydrocele sought relief. Most people preferred private practitioners (45%), followed by government hospital (36%), local registered medical practitioner (45%), traditional healer (16%), National Filaria Control Programme office (11%) in a nearby town and local PHC (11%).

Treatment costs

During the one-year study period, 74.7% (56/75) of the patients sought treatment for chronic filariasis at least once. This figure ranged from 29.33% to 41.33% during different quarters of the year. However, only 39 of those 56 patients (or 52.0% of the total sample of 75 patients) spent something on the treatment, incurring a geometric mean expenditure of Rs. 72.14 *per annum* (US $ 2.1). The overall ($n = 75$) geometric mean expenditure was Rs. 8.32 (US $ 0.24) per patient *per annum*. The expenditure on treatment varied from Rs. 33.99 (US $ 0.97) to 73.47 (US $ 2.1) during the four quarters of the year. Average annual expenditures on treatment in relation to sex, age, pathology group, duration of disease and assets (economic indicator) are given in Table 1. The distribution of costs with respect to input showed that doctor's fees and medicines accounted for about 80% (Table 2).

The proportion of people undergoing treatment was smaller in the lower income groups. Treatment cost formed 2.2%, 1.0% and 0.8% of household income of low, middle and high income groups (Table 3). Respective figures for households with patients seeking paid treatment were 44.8%, 43.4% and 81.3%.

Table 1 Annual treatment costs (in rupees) in relation to sex, age, pathology group, disease duration and assets (1993–94)

Category	*n*	Cost (GM)*	Range
Sex			
Male	20	79	2–1360
Female	19	66	7–801
Age group			
17–35 years	14	70	4–733
> 35 years	25	74	2 – 1360
Pathology group			
Hydrocele	12	65	4–1360
Lymphoedema	27	76	2–801
Both	0	0	0–0
Duration			
1–5 years	11	37	4–257
> 5 years	28	94	2 – 1360
Assets (TV/radio/cycle/fan)			
Present	17	56	4–1360
Absent	22	87	2–734

Figures rounded off to integer. * Geometric mean. Rs. 35 = US $1.0

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Table 2 Distribution of average annual treatment costs (in rupees) incurred by those who paid with respect to input (1993–94)

Input	Total cost (%)	Overall mean* $n = 75$	Mean for those who paid* ($n = 39$)	Range
Medicines	4177 (56.9)	3.8	19.1	0–780
Doctor fee	1708 (23.3)	3.2	14.6	0–300
Travel	678 (9.2)	1.7	5.6	0–100
Escort	437 (5.9)	0.6	1.4	0–180
Food & accommodation	345 (4.7)	1.1	3.2	0–80

* Geometric mean cost

Table 3 Proportion of patients seeking treatment and costs on treatment in relation to household income during 1993–94

Income group		% of patients seeking treatment	% of costs to income
Rupees	US $		
1–5000	0.9–143	44.8	2.15
5001–10 000	143–286	43.3	1.04
> 10 000	> 286	81.3	0.82

Rs. 35.00 = US $ 1.0

Work time allocation by the patients and controls

Complete disability and total loss of labour was reported during 33% ($n = 286$) of visits. However, during 27% of the visits controls were also found not taking part in any work. The difference between the two categories was not significant ($\chi^2 = 1.66$, $P > 0.05$). Chronic patients spent 4.36 ± 3.41 h per day on economic activity compared to 5.25 ± 3.52 h worked by control individuals. Both paired *t* and signed rank tests showed that the loss of mean time of 0.89 ± 4.20 h per day to patients was highly significant ($P < 0.01$) and much higher (1.36 h) for male ($P < 0.01$) than female patients (0.21 h) ($P > 0.05$). Lymphoedema (3.93 h) as well as hydrocele patients (5.10 h) worked less than their respective controls (4.64 and 6.19 h) ($P < 0.05$) (Table 4). While the mean work time lost during the first (January–March) and second (April–June) quarterly surveys was significant ($P < 0.05$), it was not so during the third (July–September) and fourth (October-December) surveys ($P > 0.05$) (Table 4). The difference in time spent on domestic activities between female patients and controls was 0.31 ± 1.42 h per day ($P < 0.05$). Males were not considered for this analysis, as domestic work in rural areas is exclusively done by women.

Logistic regression analysis showed that while chronic disease had no influence on complete absenteeism (0 h input) from economic activity ($P > 0.05$), it did influence complete inability to do domestic chores ($P < 0.05$). Multiple regression analysis showed that the disease had a significant impact on the number of hours allocated to economic activity ($P < 0.05$), but no effect on the allocation of time to domestic activity ($P > 0.05$) (Table 5).

Discussion

Patent asymptomatic infection (microfilaraemia) of lymphatic filariasis often leads to acute and then chronic disease. Acute disease causes severe disability and incurs considerable treatment costs (Ramaiah *et al.* 1998). This paper deals with the direct and indirect costs to individuals affected by chronic disease. Its manifestations – swelling and disfigurement of lower extremities of the body – are mostly irreversible and no standard treatment is available, particularly to lymphoedema

Table 4 No. of hours worked and mean difference per day between groups of patients and controls during surveys

Patient group	No. of visits	Hours worked/day: Patients	Hours worked/day: Controls	Mean difference (SD)	*t*-value	*P*†
All	286	4.36	5.25	0.89 (4.20)	3.59	< 0.01
Males	170	4.80	6.15	1.36 (4.47)	3.96	< 0.01
Females	116	3.71	3.91	0.21 (3.67)	0.61	> 0.05
Hydrocele	98	5.10	6.19	1.09 (4.58)	2.36	< 0.05
Lymphoedema	180	3.93	4.64	0.71 (3.98)	2.38	< 0.05
Males with lymphoedema	64	4.34	5.95	1.61 (4.37)	2.95	< 0.01
Survey 1	75	4.20	5.73	1.53 (4.35)	3.05	< 0.01
Survey 2	74	3.91	5.01	1.11 (4.52)	2.11	< 0.05
Survey 3	68	4.18	4.25	0.07 (4.21)	0.14	> 0.05
Survey 4	69	5.18	5.96	0.77 (3.56)	1.79	> 0.08

†Statistical significance is the same with signed rank test

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Table 5 Results of logistic and multiple regression analyses of the effect of chronic disease and age, occupation, education, asset, household type and size on absenteeism from work and number of hours worked

Activity	Independent variable	Absenteeism from work				No. of hours worked		
		CE	SE	*P*	Odds ratio	CE	SE	*P*
Economic	Chronic disease Normal = 0 Patient = 1			*		− 0.59	0.18	< 0.01
	Age 1–85 years			*				*
	Occupation Non-farmer = 0 Farmer = 1			*		0.42	0.18	< 0.05
	Education No education = 0 Primary and above = 1	0.81	0.19	< 0.01	2.25	0.68	0.18	< 0.05
	Assets No assets = 0 With assets = 1			*				*
	Household type Thatched house = 0 Tiled/concrete house = 1			*				*
	Household size 1–12	0.18	0.06	< 0.01	1.20			*
Domestic†	Chronic disease Normal = 0 Patient = 1	− 1.79	0.79	< 0.05	0.17			*
	Age 1–85 years	− 0.05	0.03	< 0.05	0.95	− 0.02	0.004	< 0.01

The variable has significant impact if $P < 0.05$. * The variable has no significant impact. † Other variables have no significant impact. CE Coefficient. SE Standard error

patients. However, this study showed that about three-quarters of chronic patients still seek treatment and half of these incur expenditure, obviously in the belief that the disease is curable (Ramaiah *et al*. 1996b). The stigma (Lu *et al*. 1988) and the social (Dreyer *et al*. 1997) and economic burden (Gyapong *et al*. 1996; Ramu *et al*. 1996) may be compelling reasons to seek treatment. The treatment costs are likely to be incurred year after year, as chronic manifestations generally do not regress with short-term treatment and in fact progress with age. Surgical treatment is a possible remedy for hydrocele, a predominant manifestation in males. Surgery for hydrocele costs Rs. 200–500 (US $ 5.7–14.3) in government hospitals and Rs.500–2000 (US $ 14.3–57.1) in private hospitals. Such high costs coupled with loss of work income during recuperation and low priority for hydrocele surgery in government hospitals prevents patients, including youngsters, from undergoing surgery (VCRC unpublished observation).

The cost of treatment was Rs. 72 (US $ 2.1) for those who paid and is equivalent to about one week's earnings of men or 10 days' earnings of women in the study area. These costs are considerable, particularly to poorer households in rural areas. As observed in patients with acute disease (Ramaiah *et al*. 1998), chronic patients from poorer households spent a higher proportion of their income on treatment than the economically better-off.

Lymphatic filariasis impairs economic activity in 53% to 88% of the patients in the form of working fewer hours, altered activity, changing jobs and stopping work (Ramaiah *et al*. 1997). We quantified the impact of the impairment on work time: compared to the loss of 3.73 h of work time per day and total disability during 87% of the episodes of acute disease patients (Ramaiah *et al*. 1998), chronic patients lost 'only' 0.89 h per day, attended work almost every day and experienced a total loss of labour of 6%. However, loss of work time in chronic patients is perpetual as the disease manifestations are mostly irreversible. At a loss of 0.89 h per day, chronic patients lose a total of 62 work days per annum, equivalent to 17% of the total work days, and their productivity is about 27% less than that of controls (Ramu *et al*. 1996). People with large hydrocele and advanced elephantiasis confine themselves to

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their homes, suggesting that this causes reduction in productivity (Kessel 1957; Wijers & Kinyanjui 1977; Wegesa *et al*. 1979; Muhondwa 1983). The total cost of filariasis will be significant if direct and indirect costs of ADL, treatment costs to the government health care system and resources spent under the National Filaria Control Programme (NFCP) in India are added to the costs of chronic disease highlighted here.

The results from logistic regression analysis indicating that the disease has no influence on patients' decision to take part in economic activity (Table 5) and the observation that chronic patients work on most days supports the hypothesis that patients learn coping mechanisms (Gyapong *et al*. 1996). However, multiple regression analysis clearly showed that the disease is an important determinant of the number of hours allocated to economic activity.

About 20% of the study population was affected by chronic disease and hence live with various degrees of disability. The disease prevalence in males and females (age groups > 10 years) was 36% and 8%, respectively. Male patients lost 1.36 work hours per day and females lost 0.31 h. Thus, about 8% of the potential male labour inputs and 0.6% of the potential female labour input were lost due to chronic disease. Gyapong *et al.* (1996) also reported that about 7% of the male labour input was lost in a subsistence farming community in Ghana.

Acute disease also causes significant direct and indirect costs and 83% of acute episodes occur in chronic patients (Ramaiah *et al*. 1996a). Thus chronic patients are burdened with the social stigma associated with disfigured body parts, direct and indirect costs caused by the ADL and chronic forms of the disease. Therefore, there is a need to develop morbidity management strategies in lymphatic filariasis. The role of surgical treatment for hydrocele and the priority accorded to it in hospitals in endemic areas also need to be reviewed.

High prevalence of chronic disease and incidence of acute disease in some regions of endemic countries (Gyapong *et al*. 1996; Ramaiah *et al*. 1996a), functional impairment and disability (Dreyer *et al*. 1997; Ramaiah *et al*. 1997), direct and indirect costs of ADL (Ramaiah *et al*. 1998) and chronic disease (Gyapong *et al*. 1996) and loss of nearly one-third of productivity in patients (Ramu *et al*. 1996) clearly suggest that lymphatic filariasis imposes a considerable economic burden on patients, their families and communities. However, control of the disease has been neglected in a number of countries. Therefore filariasis control should be given appropriate priority.

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