Original Article

The cost of tuberculosis in Cyprus in 2009

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SUMMARY. There has been a major resurgence of tuberculosis (TB) in recent years worldwide. In Cyprus the tuberculin index is below 1%, in spite of an increase in the incidence of TB, particularly among foreign residents. The purpose of this study, the first of its kind in Cyprus, was to calculate the total cost of TB in Cyprus in the year 2009. The calculation was based on complete, detailed data on patients with TB collected from the District of Nicosia, which were then used to extrapolate the cost of TB for the whole of Cyprus. The patients were divided into 5 groups: those with active and those with latent disease diagnosed in 2009, those with active and those with latent disease diagnosed in 2008 who continued treatment in 2009, and contacts in the patients' close environment who were investigated for TB in 2009. The patient records were studied and cost assessment was made for all tests, hospital days and medication prescribed for each patient for the year 2009. The cost assessment was based on Cyprus Government tariffs used for non-beneficiaries of the system. The total cost for the whole of Cyprus was estimated at €661.937.52, of which €330,768.57 was incurred by the District of Nicosia. The highest costs were generated by those patients with active disease, a mean cost of €6,479.35 per patient from the long-term care programmes within the directly observed treatment short course (DOTS) framework. For the second most costly group, the patients with latent TB, the mean annual cost per patient was €1,171.77. According to the findings of this study the cost of TB in Cyprus closely resembles that in other developed countries. *Pneumon 2012, 25(2):191-197.*

INTRODUCTION

An increase in the number of cases of tuberculosis (TB) has been observed in recent years in several developed countries including Cyprus. This phenomenon is probably associated with laxity in disease control measures. TB has been considered a "forgotten" disease in recent decades, in spite of increased population migration with an influx of citizens from third world countries, and increased numbers of people in groups with a high susceptibility to the disease[1], the AIDS epidemic, and the increasing

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frequency and variety of resilient and multidrug-resistant forms of TB (MDR-TB)[1-4].

If TB is not managed appropriately and promptly, during both the treatment of cases and application of preventive measures, significant economic costs may be incurred for a society. It is estimated that a 10% increase in the incidence of the disease worldwide results in limitation of growth of 0.2-0.4%, which translates into an economic impact of 1.4-2.8 billion US$ annually[5].

A large number of legal and illegal migrants from third world countries enter Cyprus every year. Most migrants come from countries with a high incidence of TB, and have the potential to become ill and spread the disease in the host country. An increase in diagnosed cases of active TB was observed in Cyprus between 1999 and 2009, mainly among foreign residents[6] (Table 1).

The Cypriot National Tuberculosis Commission coordinates the relevant activities, and as a result regulates the operation of TB control programmes in accordance with the international guidelines of the WHO, using the directly observed treatment short course (DOTS) framework. All services in Cyprus are offered exclusively by the public health sector, free of charge for all residents, whether they are Cypriots or citizens of other countries. This provision is made in an effort to control, monitor and restrict the spread of the disease, and to prevent relapses and the emergence of resistant forms of the disease; it includes full medical coverage for all persons suffering from TB from the initial diagnostic procedures to the final stage of treatment. For this the reason the disease is considered to be under control in Cyprus, with a low tuberculin index ranking; as estimated in 2007 for the age group of 18 years, it was classified below 1%.

TABLE 1. Registered cases of Tuberculosis in Cyprus (1999-2009)

Year	Cypriots	Foreigners	Total
1999	20	10	30
2000	18	15	33
2001	25	15	40
2002	12	8	20
2003	14	18	32
2004	7	23	30
2005	12	25	37
2006	9	28	37
2007	9	33	42
2008	9	43	52
2009	10	43	53

In Cyprus patients with active TB are hospitalized for treatment according to DOTS in the Kyperounta hospital. The Kyperounta hospital was initially founded as a sanatorium in 1942. It is located in a pine forest in the Troodos region, at an altitude of 1,130 meters. In the past it was used only for the treatment of TB, but now it is a general hospital, with 12 beds at the disposal of the pulmonologists for treating patients with TB. All the cases of active TB in Cyprus needing in- patient treatment are referred to this hospital. In the other hospitals around Cyprus TB is not treated, and the patients are only dealt with until the diagnosis is made.

The objective of this study was to calculate the total cost of TB in Cyprus in 2009, an initiative notable not only for its originality but also for its value for comparison with the relevant international literature.

MATERIALS AND METHODS

The data needed for calculating the overall cost of TB were collected from the files of patients who were diagnosed with TB at the Nicosia General Hospital. Access to patient records was approved by the Ministry of Health. This was the only possible approach, as no other district had complete data available, but because the therapeutic approach is the same for all patients, the data collected in the District of Nicosia could then be applied to the patients from the other districts and a national cost per patient for each patient group studied could be easily calculated.

The study sample was a complete census of the Nicosia region, since it included all patients diagnosed with and who received treatment in 2009, along with individuals who came into contact with contagious patients. The sample consisted of the following 5 groups of patients:

Group 1. 26 patients with active TB, registered with the relevant health service between 01/01/2009 and 31/12/2009, diagnosed in the District of Nicosia. The information was collected after a full and detailed review of the medical records of each patient. In the case of patients who continued their treatment in 2010, only the expenditures incurred in 2009 were recorded.

Group 2. 69 patients diagnosed, treated and monitored at the Nicosia General Hospital for latent tuberculosis from 01/01/2009 to 31-12-2009. As with the first group, only costs incurred in 2009 were considered, regardless of whether some patients continued monitoring and treatment in 2010.

Group 3. 17 patients who started treatment of active disease in 2008 and continued in 2009 in Nicosia. The costs considered included expenditures made in 2009 only.

Group 4. 34 patients who started chemoprevention because of latent tuberculosis in 2008 at Nicosia General Hospital, but continued in 2009 until completion. Only the costs incurred in 2009 were included.

Group 5. 140 individuals who had been in contact with contagious patients in 2009 and were investigated at the Nicosia General Hospital (contacts). The figure in this group applies to those persons who after investigation received no treatment for latent TB; those who were eventually treated for latent TB are included in group 2.

The data for TB retrieved from the Nicosia hospital are considered to be similar to those for the other districts of Cyprus, since no special characteristics have been noted relating to the establishment of the native population, the foreign residents, living conditions and treatment protocols for TB patients. As the diagnostic and therapeutic approach is uniform across Cyprus the difference in cost per case is considered to be negligible across the various districts.

During the retrieval of data from the patient records, information was recorded relating to hospitalization days, and the numbers of outpatient visits, home visits to patients by health visitors, laboratory tests (blood tests, microbiological tests), medical procedures (such as bronchoscopy, pleural biopsy) and radiological examinations (X-rays, CT scans), and the type and duration of medication. The detailed costing was based on the the official Government of Cyprus list of charges/tariffs for non-beneficiaries and on the official 2009 price list for medication. The cost of visits by health visitors was based on the gross earnings of employees and man-hours allocated to each patient.

RESULTS

As described above, data were collected for patients with TB and their contacts in the district of Nicosia, as a basis for calculating the cost of investigation and care for this particular district. For the other districts, the cost calculation was projected, using the cost per patient calculated for the Nicosia district applied to the number of local patients and contacts registered in each district. The only data available for the other districts were the total number of patients with active TB, the total months of treatment, whether or not the patients had been hospitalized in the designated hospital (the Kyperounta General Hospital), the number of contacts for each patient and which of them were advised to take chemoprophylaxis for latent tuberculosis, and demographic data of the patients with active disease status, such as country of origin, gender and age (Table 2).

Specifically, the findings for the District of Nicosia, according to the TB groups are the following:

Group 1: Patients with active TB in the Nicosia District

Of the 26 patients, 88.5% of patients were foreigners, 16 were male (61.5%) and 10 female (38.5%), with an average age of 34.2 years, ranging from 22 to 78 years; 15 were diagnosed with the pulmonary form of the disease and 11 with an extrapulmonary form. The 11 cases of with extrapulmonary TB were not considered to be a high number for Cyprus, and were found mostly in non-Cypriot patients. In the foreigners the extrapulmonary form of TB is common, as most of them had not received any treatment for TB in the past and came from countries with a high incidence of TB. The extrapulmonary form was characterized by pleural effusion and cervical lymphadenopathy.

TABLE 2. Cases of Tuberculosis in the various districts of Cyprus (2009)

District	Nicosia	Limassol	Larnaca	Pafos	Famagusta	Total
Patients with active pulmonary disease	15	12	4	6	1	38
Patients with active extrapulmonary disease	11	0	1	1	1	14
Total of patients with active disease	26	12	5	7	2	52
Number of contacts	160	25	5	12	0	202
Number of contacts who received pharmacoprophylaxis	20	6	2	5	0	33
Number of patients with active disease who were hospitalized in Kyperounta hospital	13	10	3	3	1	30

The total cost for the 26 patients with active disease diagnosed in Nicosia in 2009 amounted to €168,463.34, with an average cost per patient of €6,479.35 (Table 5). Detailed information regarding the cost of hospitalization and the cost of the various examinations is shown in Tables 3 and 4. The highest cost (46.6%) was due mostly to the long duration of hospitalization of the patients, often more than 2 months per patient. Almost as costly, however, were the examinations that also add up to high costs (43%), including those made initially before the final diagnosis of the disease and those repeated during the months-long monitoring and treatment of patients with active disease. The medications administered to the patients represented only 5% of the costs incurred.

Group 2: Patients with latent tuberculosis in the Nicosia District

This group of 69 included several subgroups, who according to specific medical criteria and based on international guidelines for the treatment of TB, were advised to take medication. Therapy for latent TB involved the administration of the drug isoniazid for 9 months, while in some cases isoniazid was combined with rifampicin and ethambutol for several months. These patients had either been in contact with a contagious person, and so were diagnosed with the latent form of the disease, or were referred by doctors checking for TB because they needed to take immunosuppressive therapy. Some were identified incidentally by Mantoux testing in certain high risk groups such as students, health professionals, people admitted to drug addiction programmes, etc. The vast majority of these patients were below the age of 34 years. The total cost for this group amounted to €80,852.75 and the average cost per patient was €1,171.77, most of which was related to visits and laboratory tests (97.5%).

A similar cost assessment was made for the three other groups. For group 3, i.e. those diagnosed in 2008 with the active disease in Nicosia and who continued treatment in 2009, the total costs amounted to €36,297.08 for the year 2009, with an average per patient cost of €2,135.12. For group 4, those in Nicosia who started chemoprophylaxis in 2008 for latent TB and who continued treatment into 2009, the total cost amounted to €40,004.8 and the average per patient cost €1,176.61. Group 5, consisting of 140 contacts who tested negative for TB, incurred total costs of €5,150.6, with an amount of €36.79 per person.

Total cost for TB for the District of Nicosia in 2009

Summing up the numbers from the 5 groups, a total cost was calculated of €326,566.07 for TB for the District of Nicosia in 2009. Table 6 shows the individual costs of patients with the active disease, the cost of patients with the latent disease, the cost of patients with active and latent disease who began treatment in 2008 and continued in 2009 and costs of people who came into contact with contagious patients but did not receive treatment.

As shown in Figure 1, the largest share of costs was incurred by patients with the active disease who were

TABLE 3. Hospitalization of patients with active Tuberculosis diagnosed in Nicosia (2009).

Place of Hospitalization	Nicosia General Hospital – Pathology	Kyperounta Hospital	ICU
Days of Hospitalization	50	775	3
Average hospitalization days per patient	8.3	59.6	3

TABLE 4. Cost of visits, tests and other medical procedures performed on patients with active Tuberculosis in Nicosia (2009).

Medical Procedure	Cost in €
Visits	3,444
X-rays	8,764.87
Microbiological tests	19,934.82
Cytology – histopathology	533.08
Other medical procedures	2,321.13
Other laboratory tests	37,484.72
Total cost	72,482.62

TABLE 5. Cost per category of care for patients with active Tuberculosis diagnosed in Nicosia (2009).

Cost category	Amount (€)	%
Cost of hospitalization	78,437.17	46.6
Cost of medical tests	72,482.62	43.0
Cost of medication	8,567.55	5.1
Cost of health visitors	8,976.00	5.3
Total	168,463.34	100
Average cost per patient	6,479.35	

TABLE 6. Total and average cost per patient for each group of patients with Tuberculosis (TB) in Nicosia in 2009

Group of patients	Cost per group (€)	Average cost per patient (€)
Group 1: Patients with active TB	168,463.34	6,479.35
Group 2: Patients with latent TB	80,852.75	1,171.77
Group 3: Patients with active TB from 2008 who continued treatment in 2009	36,297.08	2,135.12
Group 4: Patients with latent TB from 2008 who continued treatment in 2009	40,004.8	1,176.61
Group 5: Individuals who came in contact with patients with active TB but were not given therapy	5,150.6	36.79
Total	**330,768.57**	

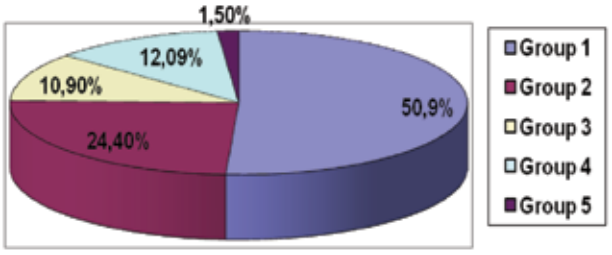

FIGURE 1. Cost as percentage (%) per group of patients with Tuberculosis TB) in Nicosia in 2009.

diagnosed and treated in 2009, who accounted for 50.9% of the costs. Patients with the active disease diagnosed and treated beginning in 2008 and continuing in 2009 made up 10.9% of the total. Patients in the latent disease category accounted 24.4% for group 2 and 12.09% for group 4, while the cost for group 5 was very small (1.5% of the total).

Projection of costs for the whole of Cyprus

According to 2009 figures, 52 cases of active TB were diagnosed and treated in Cyprus. Based on the calculations for Nicosia the average cost per patient with the active disease amounted to € 6,479.35, which means that the total cost for the 52 patients with active TB diagnosed and treated in 2009 in Cyprus was approximately € 336,926.2.

For the other groups of patients from other districts, the cost calculation was also based on the findings of the District of Nicosia (Table 7). The individual costs for each group of patients were taken into account, as shown in Figure 1, since the proportion specified for Nicosia reaches 50% of active tuberculosis cases in Cyprus and the cost of treating a case of active tuberculosis constitutes the largest portion of the total cost for Nicosia.

TABLE 7. Cost per Tuberculosis (TB) group for Cyprus in 2009, based on the cost for Nicosia

Group of patients	Cost per group of patients (€)
Group 1. Patients with active TB	336,926.2
Group 2. Patients with latent TB	161,512.75
Group 3. Patients with active TB from 2008 who continued treatment in 2009	72,151.18
Group 4. Patients with latent TB from 2008 who continued treatment in 2009	80,028.24
Group 5. Individuals who came into contact with patients with active TB but were not given therapy	9,929.06
Total	661,937.52

DISCUSSION AND CONCLUSIONS

The total cost of TB in Cyprus in 2009 was estimated at €661,937.52, with the group of patients with active TB accounting for 50.6% of the total cost, the group of those with latent TB 24.4% and the remaining 3 groups making up the rest. As demonstrated above, the largest portion of costs was from hospital care, and this is a common finding for almost all relevant studies[7-12]. In the Wartz and White study[7], the cost per patient in the US was estimated at $68,578, including the cost both of hospitalization for 20.2 days on average per patient and the many months of outpatient monitoring. In another US study, that of Shulkin and Brennan[8], the cost of hospitalization for patients who were newly diagnosed and hospitalized at a university hospital was estimated at $20,222 for each patient, with an average duration of stay of 22.7 days, excluding the cost of monitoring and treatment after leaving the hospital. Long and colleagues[13] in a Chinese study estimated that the cost per patient varied between

$149 and $724 US, an amount covering a range of from 42% to 119% of an annual household income in that country. Ricardo and coleagues[14] found that in Rio de Janeiro the cost per completed course of treatment for TB was calculated to be for DOTS strategy $726 and for SAT strategy $336, with a mean period of hospitalization of 20.8 days per patient.

In Cyprus, although the average duration of hospitalization time was much longer, 59.6 days on average, the estimated cost was much smaller. Various studies from the US indicate that the cost of active TB is much higher there than that of Cyprus. This appears to be related, on the one hand to the higher rates of insurance for health services and costs of the various tests needed in the US, and on the other to the actual healthcare charges of the Cypriot Government for non-beneficiaries, which are generally estimated to be lower than the actual cost. The cost of treating a case of TB in Britain is much lower than in the US; according to the National Health Service, when standard treatment is provided without complications the cost in Britain is £ 6,000 per case[15]

In this study, only one case of MDR-TB was identified, specifically in a patient in group 3, who received only 2 months of treatment in 2009. Fitzpatrick and colleagues, in a systematic review of the cost and cost effectiveness of treatment for MDR-TB, found that the cost per patient in Estonia, Peru, the Philippines and Tomsk was $10,880, $2,423, $143, and $745 respectively[16].

Fryatt's study[17] concludes that the therapeutic approach of DOTS is more cost-effective than self administered programmes in which the patients manage their treatment on their own and are unsupervised. Monitoring of patients on an outpatient basis appears to be more cost-effective than inpatient care from the viewpoint of the user, but on the part of suppliers many factors should be taken into account relating to the cost effective provision of services by the health system[17]. This study has documented increased days of hospitalization treatment (mean 59.6) in contrast with international studies, such as in the US (mean 22.7)[7] and in Rio de Janeiro (mean 20.8)[14]. This difference is remarkable, and is due to the following:

Treatment of TB in Cyprus is free for everyone and there is no pressure from insurance companies, something that probably prevails in the US.

There is no waiting list in Cyprus for treating TB.

In Cyprus, due to the small number of patients with active TB there is an opportunity for hospitalization of patients within the first two months of diagnosis, within the implementation parameters of DOTS, which results in better control of the disease, improved compliance and protection of public health.

The cases of active TB in Cyprus in recent years mainly concern foreign nationals. This is consistent with the international experience, where in countries with a low incidence of disease the cases of active TB are diagnosed mainly in the foreign population[18]. Dahle and colleagues, after carrying out and analyzing molecular and epidemiological studies, concluded that the transmission of TB from foreigners to locals in countries with a low incidence of disease is limited[19]. The findings of the study are consistent with the contemporary literature, since the level of disease transmission from foreigners to locals in Cyprus is low.

The findings of this study agree with data from various other European countries in terms of the age and gender of patients with TB, as more men than women in the age group 35-64 years were diagnosed with the disease[20]. According to WHO data and various studies, individuals between the ages of 25 and 55 years are mainly affected, a finding similar to that of this study[3, 21].

For patients with latent TB, the largest share of costs is related to laboratory tests performed during diagnosis, treatment and monitoring, while the smallest portion of costs was incurred by medication. TB medications are inexpensive. Specifically, isoniazid, which is used almost exclusively for the treatment of latent TB, costs only €0.06 per tablet. Conversely, the cost of laboratory tests is high, partly due to the necessity for the tests to be repeated every month as the patients are monitored for the possible side effects of medication.

Insufficient studies calculating the cost of latent TB have been reported in the international literature. The US study by Fitzgerald and Gafni[22] calculated the cost of monitoring patients with latent TB to be $4,165 per patient, which is 3.5 times that in Cyprus for this patient group. This difference appears to be associated with the high rates of medical insurance companies in the US

Several difficulties and limitations must be mentioned related to conducting this study:

• Difficulty in locating the patient files of patients with active disease in all districts other than Nicosia, leading the researchers to use the information gathered for Nicosia to project costs for the other districts.

• Limitations in the calculation of costs, since these were based on governmental tariffs, which generally provide estimates lower than the actual costs. It should be mentioned, however, that the same calculation method has been used in other studies attempting to calculate the cost of TB[7,8].

In conclusion, the cost of TB in Cyprus is under control and stationary, as in other developed countries, despite the presence of a large number of foreign immigrants and in spite of the policy for patients with active disease to be hospitalized for longer periods than in other countries. The TB control programme appears to be effective both in its design and in terms of dealing with and recording incidents. Particular attention is required for the foreign nationals of countries with a high incidence of the disease, possibly through a programme of detection and control at the primary care level. In addition, more effective control of illegal immigration, especially via the occupied areas of the Republic of Cyprus, and better management of patients, by reducing hospitalization days, could further reduce the total cost incurred by TB.

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