

# The Cost of Epilepsy in Ankara, the Capital of Turkey

## Türkiye'nin Başkenti Ankara' da Epilepsinin Maliyeti

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### Summary

**Objectives:** Epilepsy imposes a considerable economic burden on society. However, especially in Turkey, information about the direct cost of epilepsy is insufficient. The aim of this study was to compare the cost of epilepsy with that of diseases of different severity.

**Methods:** Patients were divided into five groups according to disease severity. Accordingly, Group A included newly diagnosed patients; Group B, patients with epilepsy with remission; Group C, patients with occasional seizures; Group D, active drug nonresistant patients; and Group E, drug-resistant patients. All data were collected for each patient in general hospital, and annual cost was calculated.

**Results:** One hundred sixty-three patients were evaluated. The mean annual cost for each patient was 799 Euro. Group E was the most expensive group (1830 Euro), followed by Group D (768 Euro), Group A (546 Euro), Group C (461 Euro), and Group B (390 Euro). Antiepileptic drugs accounted for the major costs in Groups B, C, D, and E, while the cost of EEG and neuroradiological imaging was more prominent in Group A.

**Conclusion:** The direct cost of epilepsy in Turkey varied depending on the severity of the condition and response to the treatment. Drugs played a significant role in the cost.

Key words: Adults; antiepileptic drugs; cost; epilepsy; treatment.

### Özet

**Amaç:** Epilepsi toplumda önemli bir ekonomik yük oluşturmaktadır. Bununla beraber, özellikle Türkiye' de epilepsinin doğrudan maliyeti ile ilgili bilgiler yetersizdir. Bu çalışmanın amacı, epilepsinin doğrudan maliyetini hastalığın şiddetine göre karşılaştırmaktır.

**Gereç ve Yöntem:** Hastalar hastalığın şiddetine göre dört gruba ayrıldı. Buna göre; Grup A yeni tanı alan epilepsi hastalarını, Grup B remisyon-daki epilepsi hastalarını, Grup C nadiren nöbetleri olan hastaları, Grup D nöbetleri ilaca yanıt vermesine rağmen devam eden hastaları, Grup E ise ilaca dirençli hastaları kapsamaktadır. Tüm bilgiler her hasta için toplandı ve genel toplam maliyet hesaplandı.

**Bulgular:** Yüz altmış üç hasta değerlendirildi. Yıllık maliyet ortalaması 799 Euro idi. Grup E maliyeti en yüksek gruptu (1830 Euro), bunu Grup D (768 Euro), Grup A (546 Euro), Grup C (461 Euro) ve Grup B (490 Euro) ile takip etmektedir. Antiepileptik ilaçlar Grup B, C, D ve E de en yüksek maliyeti oluştururken, EEG ve nöroradyolojik testler Grup A da maliyet değerlendirmesinde en belirgindir.

**Sonuç:** Epilepsinin doğrudan maliyeti hastalığın şiddetine ve tedaviye cevaba bağlı olarak değişiklik göstermektedir. İlaçlar maliyette en önemli rolü oynamaktadır.

Anahtar sözcükler: Yetişkin; antiepileptik ilaçlar; maliyet; epilepsi; tedavi.

## Introduction

Epilepsy is one of the most common neurological disorders (Incidence 29-53 cases per 100.000 per year; prevalence 5-8 cases per 1000; lifetime prevalence 3-5%).<sup>[1]</sup> In recent years the economic assessment of chronic disease has become of paramount importance because, given the limited resources assigned to health care services, a more rational allocation of the available funds is increasingly required. For this reason, the burden of the disease must be defined in terms of the number of affected individuals and the spectrum of severity.<sup>[2]</sup>

Several economic evaluations of epilepsy and its treatment have been performed in a number of countries and published in international journals.<sup>[3]</sup> The cost of medical care for persons with epilepsy was changing. New antiepileptic drugs have increased to need to access the impact of the treatment of on health care cost, to evaluate the cost effectiveness and cost benefit ratios of different drugs. Other aspects regarding the management of patients with epilepsy such as new neuroradiological techniques and surgical approaches have also increased health care costs. However, the sources of expenditure are not evenly distributed across patients with epilepsy because the disease varies widely in terms of severity and response to the treatment.<sup>[4]</sup> New drugs were increased the cost \$2000-3000 per year per patient, from \$400-1300 for previous generation of first line medications. Surgery has become an option for an increasing number of patients and even larger numbers of patients are undergoing pre-surgical assessments. So the cost of epilepsy has increased.<sup>[5]</sup> There were approximately 2.3 million people with epilepsy residing in the US in 1995, with an estimated cost of \$12.5 billion.<sup>[6]</sup>

Information about the cost of epilepsy is available mainly from Western countries.<sup>[7,8]</sup> In Turkey, information about the cost of epilepsy is insufficient. The cost of antiepileptic drugs and the cost of diagnostic techniques, blood tests

and presurgical evaluation account for a large component of direct medical costs.<sup>[9]</sup> The aim of this study was to determine the relationship between the direct costs of epilepsy with the severity of disease.

## Materials and Methods

The population in this study included 16-year-old individuals and older patients with confirmed diagnosis of epilepsy between August 2004 and August 2006. They were all followed up by neurologists at the Epilepsy Department of Ankara Training and Research Hospital. The patients were divided into five groups according to the severity of the disease (Table 1). The newly diagnosed epilepsy group (Group A) included patients whose diagnosis was first made by neurologists in our hospital. Group B (patients with epilepsy in remission at least one year) consisted of patients with complete seizure control. Group C (patients with occasional seizure) included patients with persisting seizure only one or two seizures in special case (for example hungry, sleeplessness, Ramadan fasting), but treatment changes were not necessary. Active non-drug-resistant group (Group D) included patients with recurrent seizures and treatment changes were necessary in this group. Patients in this group were responsive to these treatment changes during follow-up. Group E also included patients with recurrent seizures. However, in this group patients were not responsive to the treatment changes and the patients in this group were not available for surgery.

All data were recorded by physicians prospectively. They recorded personal details (age, sex) and socioeconomic information in a structured questionnaire. In addition to these demographic data, seizure types, etiology, the dates of the first and last seizures were collected for each patient. During a 12-month period, patients were followed up by physicians regarding seizure frequency, laboratory and diagnostic tests and hospital admission.

**Table 1.** Definitions of groups according to the severity of disease

Group A	Newly diagnosed patients (n=37)
Group B	Patients with epilepsy in remission (n=44)
Group C	Patients with occasional seizures (n=22)
Group D	Patients with active-non-drug resistant epilepsy (n=40)
Group E	Patients with drug resistant epilepsy (n=20)

**Table 2.** Age and sex distributions of patients

Groups	A (n=37)	B (n=44)	C (n=22)	D (n=40)	E (n=20)
F/M	23/14	21/23	10/12	20/20	11/9
Mean age	30.97±18.6	27.61±9.96	29.91±14.53	28.55±12.89	31.25±9.56
Age					
16-39	26 (70.3%)	39 (88.6%)	18 (81.8%)	33 (82.5%)	17 (85.0%)
40-59	6 (16.2%)	4 (9.1%)	2 (9.1%)	6 (15.0%)	2 (10.0%)
>60	5 (13.5%)	1 (2.3%)	2 (9.1%)	1 (2.5%)	1 (5.0%)
Epilepsy syndrome					
Partial	26 (70.3%)	30 (68.2%)	15 (68.2%)	30 (75.0%)	17 (85.0%)
Generalized	9 (24.3%)	12 (27.3%)	6 (27.3%)	6 (15.0%)	1 (5.0%)
Undetermined	2 (5.4%)	2 (4.6%)	1 (4.5%)	4 (10.0%)	2 (10.0%)
Occupation					
Working	12 (32.4%)	16 (36.4%)	7 (31.8%)	8 (20.0%)	2 (10.0%)
Unemployed	6 (16.2%)	6 (13.6%)	3 (13.6%)	8 (20.0%)	4 (20.0%)
Housewife	8 (21.6%)	10 (22.7%)	5 (22.7%)	10 (25.0%)	5 (25.0%)
Retired	3 (8.1%)	2 (4.5%)	2 (9.1%)	3 (7.5%)	1 (5.0%)
Student	6 (16.2%)	9 (20.5%)	4 (18.2%)	6 (15.0%)	6 (30%)
Disabled	2 (5.4%)	1 (2.3%)	1 (4.5%)	5 (12.5%)	2 (10%)

All data was collected for each patient at the Epilepsy Department of Ankara Training and Research Hospital during a 12-month period and annual cost was calculated. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS 11.0 for Windows; SPSS, USA).

## Results

One-hundred and seventy patients were included in this study, but seven patients were lost during follow-up. Thus one-hundred and sixty-three patients were evaluated in this study. The study included 76 (46.6%) male and 87 (53.4%) female. The mean age was 29.66 (range 12-76). There were 37 newly diagnosed patients, 40 patients with active-non-drug resistant, 20 patients with drug resistant epilepsy; 44 patients had epilepsy with remission and 22 patients had epilepsy with occasional seizures as shown in Table 1. The demographic features of the study population for each group are also illustrated in Table 2. In each group, majority of the patients aged between 16 and 39 years. Drug resistant epilepsy group (Group E) was the oldest group whereas epilepsy in remission was the youngest one.

Since we studied mainly with adult groups, partial seizures were the majority of the epilepsy syndrome in all groups. In Group D and E, there were much more disabled persons. Working patients were more common in Groups B, A and C, respectively. Unemployed patient ratio was between 13.6-20.0%.

The distributions of laboratory tests, diagnostic procedures and hospital services per patient during one year by each group are illustrated in Table 3. Blood tests were more common in Group A and E. Neurological evaluations prevailed for Group E which was followed by Group C and A. The other consultations included psychiatry, neurosurgery, internal medicine and orthopedics. Neuroradiological tests were mostly used in Group A and then in Group E. EEG, which was one of the important diagnostic procedures, was also more common in Group A and then in Group E.

Drug consumption patterns of the patients are shown in Table 4. The majority of patients were treated by monotherapy in Groups A, B and C. The ratio of patients in polytherapy was the highest in Group E. The percentage of antiepileptic drugs was also increased in Group E and

D. Carbamazepine and Valproate were the most common drugs in all groups.

The mean annual cost for each patient with epilepsy was 799 Euro. Group E was the most expensive group (1830 Euro), followed by groups D (768 Euro), A (546 Euro), C (461 Euro) and B (390 Euro). The distribution of cost ratio in groups (blood tests, hospital services, neuroradiological investigations) is shown in Table 5. Antiepileptic drugs established the major cost in all groups except in Group A while

the cost of EEG and neuroradiological imaging was more prominent in Group A. Antiepileptic drug treatment ratio cost increased dramatically from the newly diagnosed group (Group A) to the drug resistant group (Group E) just like the new antiepileptic drug cost ratio.

## Discussion

This study was clinic-based; therefore, the study population may not represent all epilepsy patients in the commu-

**Table 3.** Laboratory and diagnostic tests in groups

Groups	A	B	C	D	E
	Number/patient	Number/patient	Number/patient	Number/patient	Number/patient
Blood count	4.2	2.5	2.7	3.0	3.9
Transaminases	4.5	3.1	3.3	3.8	4.5
Glucose	2.5	0.7	1.4	1.9	2.0
Creatinine	0.5	0.4	0.4	0.8	0.8
Plasma drug concentration	1.7	0.5	0.8	1.4	2.1
EEG	2.2	0.6	0.7	1.3	1.7
CT	0.6	0.1	0.1	0.2	0.2
MRI	0.6	0.05	0.1	0.3	0.7
Neurology consultation	4.9	3.6	3.9	5.0	5.6
Other consultation	0.2	0.3	0.2	0.3	0.5
Hospital admission	0.2	0.0	0.0	0.2	0.4
Number of day in hospital	2.5	0.0	0.0	3.1	5.5

**Table 4.** The distribution of antiepileptic drugs in groups

Groups	A	B	C	D	E
	(n=37)	(n=44)	(n=22)	(n=40)	(n=20)
	n (%)				
Carbamazepine	14 (37.8)	14 (31.8)	9 (40.9)	26 (65.0)	15 (75.0)
Valproate	15 (40.5)	18 (40.9)	10 (45.0)	18 (45.0)	13 (65.0)
Phenytoin	6 (16.2)	5 (11.4)	1 (4.5)	4 (10.0)	–
Lamotrigine	1 (2.7)	2 (4.5)	1 (4.5)	5 (12.5)	8 (40.0)
Topiramate	–	1 (2.3)	1 (4.5)	2 (5.0)	3 (15.0)
Vigabatrin	–	1 (2.3)	–	–	1 (5.0)
Levetracetam	–	–	1 (4.5)	2 (5.0)	5 (25.0)
Benzodiazepine	–	–	–	1 (2.5)	–
Gabapentin	–	–	–	–	1 (5.0)
Oxcarbazepine	3 (8.1)	5 (1.4)	1 (4.5)	1 (2.5)	2 (10.0)
Barbiturates	–	–	–	1 (2.5)	–

**Table 5.** Annual cost (in Euro) per patient in groups

Groups	A (n=37)	B (n=44)	C (n=22)	D (n=40)	E (n=20)
	Cost/patient	Cost/patient	Cost/patient	Cost/patient	Cost/patient
Blood tests	71 (13.0%)	42 (10.8%)	51 (11.1%)	78 (10.2%)	96 (5.2%)
EEG-Neuroradiology	202 (37.0%)	39 (10.0%)	49 (10.6%)	104 (13.5%)	165 (9.0%)
Hospital services	73 (13.4%)	28 (7.2%)	31 (6.7%)	52 (6.8%)	129 (7.1%)
AED					
Total	200 (36.6%)	281 (72.0%)	330 (71.6%)	534 (69.5%)	1440 (78.7%)
New drugs (Cost %)	7.5	32.6	33.5	34.6	60.8
Total cost (€)	546	390	461	768	1830

nity. In this study, we evaluated the direct cost of epilepsy according to the disease severity. The cost of epilepsy in Turkey varied depending especially on the severity of the disease and the response to the treatment. Some of the findings of our study was similar to the previous studies,<sup>[7,8]</sup> but there were some important differences.

Guerrini et al. evaluated the cost of epilepsy in children according to the severity of disease. In that study, drug resistant epilepsy was the most expensive group followed by newly diagnosed epilepsy, active non-drug resistant epilepsy and epilepsy in remission groups. Hospital services were the major cost in all epilepsy groups.<sup>[2]</sup>

Another study reported by Begni et al. also investigated the cost of epilepsy from a nationwide survey comparing adult patients who were included in different prognostic criteria. They concluded that the cost of epilepsy in referral patient varied significantly according to the response to the treatment. Hospital admission and antiepileptic drugs, especially new drugs, established the major part of the cost.<sup>[4]</sup>

Al-Zakwani et al. demonstrated that the newer antiepileptic drugs were significant predictors of the total cost.<sup>[10]</sup> Another report concluded that treating epilepsy patients by using phenobarbiturate reduced the cost.<sup>[11]</sup> Tetto et al. also investigated the cost of epilepsy in Italy and they concluded that total annual costs varied significantly across the groups. Surgical candidates were the most expensive group but occasional seizure group was the cheapest one.

<sup>[1]</sup> Reports from the United Kingdom suggested that the greatest source of the direct costs that of hospital based care were followed by drug treatment.<sup>[12-14]</sup>

In our study, the antiepileptic drugs were the major cost in Group B, C, and D. In Group A diagnostic procedures such as EEG, Cranial CT and/or MRI were the most important part of the direct cost of epilepsy and this cost was followed by antiepileptic drugs. Because, diagnostic procedures, that were necessary to identify the epilepsy type and etiology, were more commonly used in this group. Another explanation for cost ratio for Group A, conventional antiepileptic drugs, which were cheaper than the newer drugs, were firstly used, so the cost ratio of antiepileptic drugs was relatively decreased. The cost ratio of antiepileptic drugs were increased dramatically from newly diagnosed group (Group A) to drug resistant group (Group E) while newer antiepileptic drugs were used more commonly especially in Group D and E. Most of the European studies especially patients with poor response to treatment, hospital services were the major source of the cost and this was followed by the antiepileptic drugs.<sup>[1-2,4,12-14]</sup> In general, the costs of hospital services and especially neuroradiological imaging in our country were very cheap compared to European countries. However, there was not so much difference in terms of the cost of drugs. Therefore, the results of our study had some differences from the previous studies that were carried out in European countries and the USA.

The design of this study has some limitations. First, this study was designed in the general hospital. If the patients had been investigated in a university hospital, the direct cost of epilepsy per patient, especially in terms of hospital services, long term EEG and neuroradiological techniques would have been higher because of further sophisticated evaluations. Second, the majority of our patients in each group had partial onset seizures. The number of patients

in generalized epilepsy was very limited, so we could not compare the direct cost of epilepsy in partial onset and generalized seizures. Third, the study population included mainly adults; therefore, we could not carry these results to the children.

In conclusion, this is the first study to evaluate the direct cost of epilepsy in Turkey. Further investigations using the same design are necessary to calculate the direct cost of epilepsy in pediatric and adult patients, in partial onset and generalized seizures, in general and university hospitals, and at different socioeconomic levels.

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