Epilepsy in Action

The current climate and intervention proposals for improving the lives of people who live with epilepsy
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Epilepsy is one of the most common chronic neurological disorders. Approximately 50 million people of all ages throughout the world suffer from it. It is a highly complex pathology characterised by excessive uncontrolled neuronal discharges, called epileptic seizures. This disorder is also closely linked to neurobiological, cognitive and social consequences, which vary according to the severity of the clinical status of each patient.

Although the majority of people have heard of epilepsy, only those who suffer from it, their family members and experts in the field understand it and are well informed about the physical, psychological and social burden the disorder entails. The great majority of society lacks information and is conditioned by social stigma, stemming from ancient beliefs about the human being which still have negative effects on the social integration of these patients today.

Epilepsy affects approximately 345,000 people in Spain, of whom around 29,000 are children, although these figures are inaccurate, since there are no national epidemiological studies or patient registers. Although the condition affects patients of all ages, the incidence is particularly high in children. According to the experts, this disorder is the primary cause of paediatric neurological consultations. Its prevalence is also high in the elderly and is expected to increase at a considerable rate in upcoming years.

The prognosis of the disorder is highly variable. 70% of patients who receive pharmacological treatment are able to successfully eliminate the seizures. However, the remaining 30% suffer from seizures which cannot be controlled by drugs and require alternative treatments. Furthermore, between 25% and 40% have cognitive problems of diverse severity, which may simply entail learning difficulties or reduced cognitive and psychomotor skills. The experts highlight that 14% of paediatric patients suffer from severe epilepsy, associated with delayed development.
The complexity of epilepsy requires specialist, comprehensive and coordinated care from all the healthcare levels involved. Although in recent years specialist care has evolved, there are still many regional health services without the resources or professionals who specialise in epileptology. As a result, in Spain, only 25% of patients are attended by a neurologist who specialises in epilepsy. The diagnosis of the disorder is relatively simple, although there is still limited access to certain tests and resources, which often delays the process. Experts in the field emphasize the need to promote actions and initiatives to promote standardized, multidisciplinary and comprehensive care.

With regard to the financial impact, epilepsy currently accounts for almost 3% of annual health service expenses, costing the system 2.76 thousand million euros annually. This includes healthcare costs and non healthcare costs, sick leave losses and other expenses paid by the patient. It is of note that in recent years the management of epilepsy has evolved considerably in terms of social involvement and the struggle to ensure good quality of life for the patient. Despite this, epilepsy still has a high social and emotional impact for the patient. In this regard, one of the most important aspects to address is the promotion of complementary services and assistance for all patients so as to reduce as far as possible the negative impact of the disorder on their quality of life and relationships, and to foster their integration into society.

Below are some of the goals to improve healthcare in Spain:

- Creation of a clinical guide for a generalised approach throughout the national health system that empowers and accommodates innovation to improve the quality of life of the patients
- Higher specialisation and training of multidisciplinary teams to care for the epileptic patient at all levels of healthcare
- Creation of new medical epilepsy units in the different regional health services, and the enhancement of existing medical-surgical units
- Investment in key diagnostic systems, such as the prolonged EEG video
- Promotion of complementary services and psychological support for the patient
- Creation of a nationwide patient register
- Higher awareness and education at all levels of society

In the light of this situation, coordinated work by the different agents involved in epilepsy healthcare, at both a clinical and a social level is essential to promote and drive the provision of professional training, raise consciousness and educate society and to offer the patient the complete, personalised care they require.
1 Introduction
1. Introduction

Epilepsy is one of the most common chronic neurological pathologies in our society. It may present in any person and at any age, impacting on a personal, social and financial scale. This pathology is complex and requires comprehensive, multidisciplinary care. There is also strong discrimination and social stigma attached to it, due to ancient beliefs regarding the disorder.

Although in recent years there has been an increase in initiatives to disseminate information about epilepsy, and to raise awareness and educate society, we still have a long way to go before discrimination is completely eradicated and epilepsy patients can become fully integrated into society. Actions are also needed to promote greater specialisation in healthcare.

The aim of this report is to explain what epilepsy entails, to present the current situation, describe the care model patients receive and pinpoint the main areas for improvement. Its ultimate objective is to propose possible actions designed to achieve improvement in healthcare and quality of life for the patient. The report has been developed from a thorough, detailed review of the literature, together with participation from healthcare professionals and highly prestigious experts in the field of epilepsy, who have contributed their experience, knowledge and vision on the current situation and patient needs.

The most relevant aspects of epilepsy are presented in the second chapter of this report, with a description of the main symptomology, aetiology and principle risk factors. Information is also provided on the wide range of disorders and syndromes that the disorder encompasses. Chapter three examines the current situation in terms of epidemiology, from international, European and national perspectives. It also highlights the importance of the key agents in management of the disorder, including the main clinical and scientific societies, and the most influential patient associations, together with their main objectives and lines of action.

Chapter four of the report focuses on the description of the current care model in Spain, offering a general view of the patient pathway at different healthcare levels. In this section details are provided of the different services and professionals involved in the process, including diagnosis and treatment, in addition to clinical and social patient follow-up. Chapter five presents an analysis of the financial and social impact epilepsy may have nationally and of the personal and psychological burden patients and their family members face as a consequence of this disorder.

Finally, based on the study as a whole, a series of challenges to be addressed are put forward, in response to the key needs pending. We also propose a series of initiatives and actions to improve healthcare and quality of life for these patients, with particular emphasis on raising awareness and educating society at all levels on the main features of this disorder.
2 Description of epilepsy
2. Description of epilepsy

2.1 What is epilepsy?

Epilepsy is a disorder of the central nervous system (CNS) characterized by epileptic seizures. An epileptic seizure is an excessive, disorderly discharge of a high number of neurons which occurs unexpectedly. It is one of the most ancient and mysterious disorders in the history of medicine. Reports can be traced back more than 2000 years, when the first attempts were made to describe the condition and explain its causes (1).

It is important to note that having experienced an isolated epileptic seizure does not necessarily mean that a person has epilepsy. According to the International League Against Epilepsy (ILAE), epilepsy is a neurological pathology diagnosed subject to these three conditions (2):

- Suffering from at least two seizures separated one from the other by over 24 hours
- Suffering from one unprovoked epileptic seizure and with at least 60% risk of suffering from new seizures, a risk which is similar to that derived from having two unprovoked seizures
- Diagnosis of an epileptic syndrome

Epilepsy may affect people of any age, race and gender and is a little more common in men than in women. No single epilepsy patient profile exists, since anyone might develop the condition, regardless of economic, social or demographic factors. In fact, several sources report that up to 10% of the population (depending on the region) will suffer from an epileptic seizure at some time in their lives (3).

According to the Spanish Society of Neurology (SEN), approximately 40% of epilepsies are caused by a structural or metabolic disorder in the central nervous system (4). This may be of prenatal or perinatal origin, due to trauma, a developmental malformation, a tumour, a CNS infection or cerebrovascular disease. By comparison, the percentage of epilepsies without apparent cause is low (< 5%), but they are associated with a potential genetic origin (5). In this regard, it is estimated that epilepsies with no known cause comprise over a third of all epilepsies (6).

The number of new cases every day is considerably higher at each end of the age spectrum, i.e. epilepsy has a higher incidence rate in children and old people. There are different reasons for this: for 3 out of every 10 children with epilepsy, it is of unknown cause (7), whilst over half of cases of epilepsy in the elderly occur as a result of structural or metabolic causes, from cerebrovascular diseases, brain tumours, dementia, infections or trauma (8).

Epilepsy is considered to be a chronic pathology, i.e. incurable. Its severity and prognosis is highly variable, depending on the type of epilepsy. It is not usually severe and the outcome is favourable in cases controlled by pharmacological treatment. It is worth noting that, especially in pre-school and school children, epileptic seizures may even go untreated (5). For other patients, however, epilepsy is a constant health problem throughout their lives.

Seventy percent of patients who have access to pharmacological treatment have their disorder under control, i.e. they live without seizures and lead a practically normal life. In contrast, the other 30% suffer from an epilepsy which does not respond to drugs, known as refractory (3), because pharmacological treatment is unable to eliminate the seizures, although in many cases it can reduce their frequency and severity.

Approximately 25% to 40% of those affected have some type of intellectual disorder, neurological impairment or cognitive or behavioural disorder (5). Furthermore, people with epilepsy are inevitably subject to the impact their disorder has on society and are likely to suffer neurobiological and cognitive as well as psychosocial consequences (9).

Patients with epilepsy have been subjected to continual discrimination and social stigma, as a result of ignorance, fear or incomprehension. Even today, some patients with epilepsy prefer to conceal their disorder (6), which actually leads to less social awareness and a lack of understanding in society as a whole. However, in recent years a great many epilepsy patient associations have flourished and are setting up initiatives to eliminate the stigma and to normalise the disorder. Their common objective is to minimise the psychosocial impact on patients and to fight for a better quality of life.
Risk Factors

Up until now, a large number of epilepsies have not been associated with a single obvious cause. However, several studies flag up numerous factors which increase the risk of suffering from this disorder (6):

- Head injuries
- Cerebrovascular diseases
- Degenerative CNS diseases
- Infections in the central nervous system, such as meningitis or encephalitis
- Brain tumours
- Congenital malformations of the CNS
- Chromosomal syndromes
- Inborn errors of metabolism with CNS involvement
- Acquired metabolic disorders such as hypoglycaemia or chronic kidney failure
- Perinatal problems such as cerebral anoxia (insufficient oxygen to the brain)
- Excessive consumption of alcohol and drugs
- Exposure to toxic elements such as lead, mercury or carbon monoxide

Although the majority of factors are associated with diseases, tumours or trauma, there is a genetic predisposition to the disorder due to the alteration of one or several genes. In recent years, research and development into genetics has established a relationship between a wide variety of genes and several syndromes and diseases (10).

2.2 Epileptic seizures

Epileptic seizures in themselves are not epilepsy, but a symptom or disorder with several causes. Symptoms are very diverse and may include loss of consciousness, sensory and emotional changes, convulsive twitching or sudden loss of muscle tone.

Many types of seizures exist but in general, they are classified into two well-differentiated types depending on the location of their origin. The seizures are termed generalised when a large number of neurons along the cerebral cortex are affected, and focal (also termed partial) when only one group of localised neurons in one of the two hemispheres are affected. In some cases, a focal seizure may spread to both cerebral hemispheres and therefore ‘generalise’ (11).

Figure 1. Types of seizures according to location

Epileptic seizures may also be classified as motor, if some type of movement occurs during the event, or non motor, if other symptoms are included such as changes in perception, sensations or emotions. Moreover, several experts highlight the importance of distinguishing the degree of consciousness during partial seizures, since they may occur with the patient being totally aware or they may involve a loss of consciousness or a change in awareness (12).

In some cases, the available information is insufficient or limited and it is impossible to determine whether the seizures are focal or generalised. Some authors therefore group them into a third group of seizures of unknown origin. Table 1 and Table 2 show the types of seizures according to the classification proposed in 2017 by the ILAE (13), divided into the two large blocks (focal and generalised).
### Table 1. Main types of focal epileptic seizures

<table>
<thead>
<tr>
<th>Focal Seizures</th>
<th>Type of seizure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor seizures</strong></td>
<td>Focal automotor seizures</td>
<td>Automatic, involuntary behaviour, such as rubbing hands together, smacking lips, chewing or other complex movements</td>
</tr>
<tr>
<td></td>
<td>Focal atonic seizure</td>
<td>Loss of muscle tone in one part of the body, e.g. a limb, becoming inert for approximately 15 seconds</td>
</tr>
<tr>
<td></td>
<td>Focal clonic seizure</td>
<td>Movement at one side or part of the body or the face</td>
</tr>
<tr>
<td></td>
<td>Focal seizure of epileptic spasms</td>
<td>Sudden flexion or extension of the body and head for 1 to 5 seconds</td>
</tr>
<tr>
<td></td>
<td>Hyperkinetic focal seizure</td>
<td>Automatic movements with great range of movement of the extremity or trunk muscles leading to, for example, pedaling movements</td>
</tr>
<tr>
<td></td>
<td>Myoclonic focal seizure</td>
<td>Brief, irregular twitching of a muscle or group of muscles</td>
</tr>
<tr>
<td></td>
<td>Tonic focal seizure</td>
<td>Sudden rigidity in one part of the body</td>
</tr>
<tr>
<td><strong>Non motor seizures</strong></td>
<td>Autonomic focal seizure</td>
<td>Experiencing a sensation of shivering and/or palpitations</td>
</tr>
<tr>
<td></td>
<td>Focal seizure with interruption of behaviour</td>
<td>Cessation of all movement with the person becoming immobile or frozen</td>
</tr>
<tr>
<td></td>
<td>Cognitive focal seizure</td>
<td>Cognitive impairment, which may affect language, spatial perception, mathematical calculation ability or other functions</td>
</tr>
<tr>
<td></td>
<td>Emotional focal seizure</td>
<td>Sudden feeling of fear, anxiety or, less frequently, happiness and which may induce involuntary laughter or crying</td>
</tr>
<tr>
<td></td>
<td>Sensory focal seizure</td>
<td>Feeling of tingling, numbness, visual symptoms, sounds, smells, tastes, dizziness, cold and heat</td>
</tr>
</tbody>
</table>

Source: International League Against Epilepsy (ILAE), 2017.

### Table 2. Main types of generalised epileptic seizures

<table>
<thead>
<tr>
<th>Generalised Seizures</th>
<th>Type of seizure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor seizures</strong></td>
<td>Generalised tonic-clonic seizure</td>
<td>Sudden loss of consciousness, stiffness throughout the body at the beginning (tonic phase) and then rhythmic movements throughout the body (clonic phase) Crying may occur at the beginning of the seizure, in addition to falling, biting of the tongue or incontinence</td>
</tr>
<tr>
<td></td>
<td>Generalised clonic seizure</td>
<td>Rhythmic movements throughout the body and head</td>
</tr>
<tr>
<td></td>
<td>Generalised tonic seizure</td>
<td>Instant rigidity of the muscles throughout the body</td>
</tr>
<tr>
<td></td>
<td>Generalised myoclonic seizure</td>
<td>Sudden instant numbness throughout the body and especially in upper limbs</td>
</tr>
<tr>
<td></td>
<td>Generalised myoclonic-tonic-clonic seizure</td>
<td>Generalised tonic-clonic seizure preceded by myoclonic convulsions in both sides of he body</td>
</tr>
<tr>
<td></td>
<td>Generalised myoclonic-tonic-clonic seizure</td>
<td>Myoclonic numbness followed by a soft fall</td>
</tr>
<tr>
<td></td>
<td>Generalised atonic seizure</td>
<td>Sudden fall from loss of muscle tone and consciousness for a few short seconds</td>
</tr>
<tr>
<td></td>
<td>Generalised seizure of epileptic spasms</td>
<td>Brief convulsions with flexion of the trunk and extension of the extremities</td>
</tr>
<tr>
<td><strong>Non motor seizures</strong></td>
<td>Typical generalised absence seizure</td>
<td>The person is immobile, has lost consciousness and has a fixed gaze for approximately 15 seconds, with automatic behaviour in several cases</td>
</tr>
<tr>
<td></td>
<td>Atypical generalised absence seizure</td>
<td>Suffering from a typical generalised absence seizure with a gradual beginning and end</td>
</tr>
<tr>
<td></td>
<td>Generalised myoclonic absence seizure</td>
<td>Twitching followed by absence seizure</td>
</tr>
<tr>
<td></td>
<td>Generalised eyelid myoclonus</td>
<td>Twitching of the eyelids and upward movement of the eyes sometimes accompanied by absence seizures</td>
</tr>
</tbody>
</table>

Source: International League Against Epilepsy (ILAE), 2017.
2.3 Types of epilepsies and epileptic syndromes

Epilepsy is highly complex as it groups together a very extensive set of disorders where the main symptom is an epileptic seizure (11). The type of epilepsy is diagnosed according to the type or types of seizure. If the seizure type is unknown, the epilepsy type will also be unknown.

If the patient suffers from a series of specific characteristics they may be diagnosed with what is known as an epileptic syndrome, a disorder which groups together a series of well-defined clinical signs. They may be of diverse aetiology, i.e. they may be due to many causes, or the trigger for the seizure may be unknown. The type of syndrome will depend on the characteristics, severity and frequency of the seizures; the age and time of onset and the presence of other neurological or general anomalies.

Knowledge of the epileptic syndromes is essential to make a diagnosis and provide appropriate treatment. The following table contains the current list agreed by the major international bodies specialising in epilepsy, epilepsies and epileptic syndromes (14), (11).

Figure 2. Epilepsies and epileptic syndromes according to age of onset

<table>
<thead>
<tr>
<th>Neonatal period</th>
<th>Benign neonatal seizures</th>
<th>Benign familial neonatal epilepsy</th>
<th>Early onset epileptic encephalopathies: Ohtahara syndrome and early myoclonic encephalopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infancy</td>
<td>Febrile seizures</td>
<td>Benign early infancy epilepsy</td>
<td>West syndrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benign familial early infancy epilepsy</td>
<td>Dravet syndrome or severe early infancy myoclonic epilepsy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Early infancy myoclonic epilepsy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Myoclonic encephalopathy in non progressive disorders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Epilepsy of infancy with migrating focal seizures</td>
</tr>
<tr>
<td>Childhood</td>
<td>Febrile seizures</td>
<td>Early onset childhood occipital epilepsy (Panayiotopoulos syndrome)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Epilepsy with myoclonic-atonic seizures (Doose syndrome)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Childhood absence seizures</td>
<td>Benign epilepsy with centrotemporal or rolandic spikes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Autosomal dominant nocturnal frontal epilepsy</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Late onset childhood occipital epilepsy (Gastaut type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Epilepsy with myoclonic absences</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lennox-Gastaut syndrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Epileptiform encephalopathy with continuous spike and wave during sleep</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Landau-Kleffner syndrome</td>
</tr>
<tr>
<td>Adolescence and adulthood</td>
<td>Teenage myoclonic epilepsy</td>
<td>Teenage absence epilepsy</td>
<td>Epilepsy with generalised tonic-clonic seizures only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Autosomal dominant epilepsy with auditory features</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other familial temporal lobe epilepsies</td>
</tr>
</tbody>
</table>

As Figure 2 and Figure 3 show, a high number of disorders can be classified in accordance with the patient’s age at onset, whilst others are of variable age of onset. There are other epilepsies which are not dependent on the age of onset, but which do have a series of common characteristics or are associated with structural-metabolic causes. It is worth noting that seizures during early infancy and childhood are not in themselves considered to be an epileptic disorder (15).

Although the majority of childhood epilepsies have a favourable prognosis (6) (16), there are others which mainly appear during the first 3 years of life, and are characterised by their severity, poor prognosis and the refractory course of the disorder. These include encephalopathies and in particular the Ohtahara syndrome, West syndrome, Dravet syndrome and Lennox-Gastaut syndrome (16), (17), (18).
The current climate on Epilepsy
3. The current climate on Epilepsy

3.1 Today’s epilepsy situation worldwide

Worldwide incidence and prevalence

Epilepsy is one of the commonest neurological pathologies, together with Parkinson’s disease, multiple sclerosis, Alzheimer’s disease and other dementias. Worldwide prevalence ranges between 0.4% and 1.4% of the population, depending on the country or region. It has been estimated that there are currently around 50 million people affected in all regions of the world, and therefore it can be considered a global public health problem (3).

As can be observed in Figure 4, the prevalence of epilepsy throughout the different countries in the world is uneven. Eighty percent of those affected live in developing countries, where an estimated 75% have limited access to treatment (3). Moreover, there are huge inequalities in access to diagnosis and to specialist care.

The highest prevalence of epilepsy is in Africa and America, with rates of 11.29 and 12.59 per 1,000 inhabitants, respectively, followed by the south-east Asian countries with 9.97 people out of every 1,000 affected and Eastern Mediterranean countries with 9.4 people out of every 1,000 affected. The lowest rates occur in European countries with 8.23 people affected, and in particular in Western Pacific countries with just 3.8 people affected per 1,000, although it is quite possible that prevalence in the latter countries are rarely reported (19).

With regards to incidence, between 24 and 53 new cases appear every year per 100,000 inhabitants in developed countries; whilst in developing countries up to 190 new cases appear every year per 100,000 inhabitants (3). Although it is difficult to align this inequality with racial or socio-economic factors, several experts believe that incidence is higher in developing countries with low per capita incomes, due to the higher frequency of HIV1, head injuries, disorders of prenatal and perinatal origin and consanguinity (19).

Figure 4. Distribution of the worldwide prevalence of epilepsy. Number of people affected per 1,000 inhabitants (n = countries assessed by region)


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1 (HIV) Human Immunodeficiency Virus, responsible for acquired immunodeficiency or AIDS.
Mortality

Although the prognosis for many epilepsy cases is positive, the risk of death is up to 3 times higher than that of a healthy person, in the majority of cases, due to causes of an accidental nature and/or underlying diseases (20), (21).

The mortality rate peaks during the first few years of life (22) and is more common in epilepsies with structural/metabolic causes than in those of genetic origin (20). Furthermore, during the first few years following onset the risk of mortality is higher (20), (23).

Causes directly associated with epileptic seizures (12.5%) stand out among the main causes of death. This may be trauma or the epileptic state itself, and are most common in elderly patients due to the presence of other diseases which complicate treatment.

Furthermore, sudden death in epilepsy patients, known as SUDEP2, with an incidence rate of between 0.5 and 2 per 1,000 patients per year, is one of the highest causes of death (2%-18%) and the major cause of death in patients with refractory epilepsy. Although the factors leading to sudden death are not altogether yet known, the experts consider that they are somehow linked to epilepsy. There are also other causes of death such as suicide (<2%) or other deaths related to complications with medication (24).

3.2 Situation in Europe

Europe has one of the lowest rates of epilepsy, yet the WHO estimates that there are approximately 6 million Europeans affected throughout the 53 countries with a mean prevalence of 8.2 people per 1000 inhabitants (25), and an incidence of around 300,000 new cases diagnosed each year.

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2 Sudden Unexpected Death in Epilepsy Patients. This is sudden or unexpected death, overlooked or not by witnesses. It is non-traumatic and not caused by choking, in patients with epilepsy, with or without evidence of convulsion (excluding the epileptic status documented), where in a postmortem examination no toxic or anatomical factors which may explain the death are determined (74)
The incidence of the disorder is higher during the first few years of life and in people over 65, due to the ageing population and consequent increased risk of cerebrovascular diseases. For this same reason, it is predicted that the incidence in older people will increase in upcoming years. This trend is observed in Europe and in the other developed countries (3), (25).

Figure 7. Distribution of incidence per 100,000 inhabitants according to age and gender


Up until now, studies have indicated that epidemiological distribution and characteristics are uniform and similar throughout European countries. According to several sources, the rate of the disorder in the five most highly populated European countries ranges from 0.62% to 0.98%, which is approximately 345,000 people affected in Spain (20), 402,000 in the United Kingdom (27), 500,000 in Italy (28), 522,000 in France (29), and 810,000 in Germany (30). Other less populated countries, like Sweden with 70,000 people with epilepsy, also have a similar prevalence to the above-mentioned rage.

Figure 8. Prevalence of epilepsy in the main European countries (Germany, Spain, France, Italy, United Kingdom and Sweden).

National patient registers are key to the study and control of epilepsy epidemiology in Europe as a means of reliably identifying the total number of people affected by this disorder. In the last few years, for example, Sweden has produced a national register of patients containing eight neurological diseases that includes epilepsy and this has led to an accurate estimate of the total number of people affected by this disorder.

At present, several Northern countries such as Norway, Sweden, Denmark, Finland or the Low Countries have national patient registers which enable them to effectively manage healthcare services and resources relevant to each disorder, in addition to providing national studies on the disorder (33).

Nonetheless, in the majority of European countries, there is no system for registering people with epilepsy, thus making epidemiological data collection and analysis difficult.

On a global level, we found epilepsy registers of a more specific nature, aimed at specific patient groups. Such as the international register of pregnant women with epilepsy undergoing pharmacological treatment, EURAP (34). To date, over 23,900 pregnant women have been registered in 42 countries in Europe, Australia, Asia and South American, to compare the safety of the different antiepileptic drugs during pregnancy and expose any potential risks to the newborn infant (34).

It is also important to underline the financial impact epilepsy has in Europe. According to studies, healthcare costs associated with epilepsy in Europe amount to 12,800 million euros per year (35). The cost per patient differs according to national income and the healthcare costs of each country. However, in general, the majority of the costs are not associated with healthcare but with other indirect costs deriving from this disorder (36).

Key international and European agents in epilepsy care

Over the last few decades, technological advances have resulted in new diagnostic systems, and this, together with the appearance of new drugs and the specialisation of medical professionals, has contributed towards improving healthcare for patients with epilepsy. However, the experts state that further advancement and the standardisation of clinical practices are required to guarantee all patients fully comprehensive healthcare.

Here we should underline the importance of scientific epilepsy societies which propose treatment guidelines and which help medical professionals to manage epilepsy patients. On an international level, the ILAE is considered one of the most important international agents charged with raising awareness of the disorder and promoting research, education and professional training (37). It also has commissions representing the different regions of the world, which include the commission for European affairs, to promote a more local form of these initiatives.

The IBE (International Bureau of Epilepsy), which comprises national epilepsy organisations, seeks to establish a global network to promote international collaboration in the struggle for the social, educational and professional rights of patients with epilepsy (38).

On a European level, one recent creation of note is that of the EAE (Epilepsy Alliance Europe) in 2015, under the auspices of the ILAE, together with the IBE. This European group is implementing a series of initiatives at different levels such as, ESBAE (European Study on the Burden and Care of Epilepsy), to promote high quality care at all stages of the disorder on an equal basis throughout the European Union, Epitarget, which focuses on research into biomarkers for the early prediction and diagnosis of the illness, and Radar-CNS, which advocates the potential of wireless technology, using smart phones and other wearable devices3 to improve the quality of life of epilepsy patients (39).

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3 A wearable device is an electronic device designed to be worn on the clothes or body which is able to record data or to monitor the user. Recent innovations in these devices have led to considerable improvements in healthcare management, increasing the efficacy and popularity of home telemedicine.
Research efforts should also be mentioned, together with the goals achieved to date in patient care, in terms of diagnosis, treatment and follow-up. The most important advances in recent years are related to the discovery of genes associated with epilepsy, improvements in encephalogram techniques and useful functional neuroimaging for both diagnosis and research. In addition, there are now new antiepileptic drugs with fewer adverse effects. However, these advances must continue to achieve more effective drugs with better tolerability, and to cover priority areas of research towards a better understanding of childhood epilepsies and brain development, the prevention of illness after a brain injury and the identification of the origin of the seizure \((40)\).

3.3 The situation in Spain

There are increasingly more chronic diseases in Spain, partly due to increased life expectancy and developed-country lifestyles, among other factors. Also, according to the national health organisations, central nervous system disorders are increasingly more significant within the group of chronic illnesses.

**Figure 9. Prevalence (%) of the most common chronic disorders in Spain**

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT</td>
<td>18.5</td>
</tr>
<tr>
<td>Arthritis or rheumatism</td>
<td>18.1</td>
</tr>
<tr>
<td>Migraine</td>
<td>12.0</td>
</tr>
<tr>
<td>CKD</td>
<td>9.2</td>
</tr>
<tr>
<td>Diabetes*</td>
<td>7.8</td>
</tr>
<tr>
<td>Depression</td>
<td>5.9</td>
</tr>
<tr>
<td>Asthma</td>
<td>4.1</td>
</tr>
<tr>
<td>Cancer</td>
<td>3.2</td>
</tr>
<tr>
<td>Neurodegenerative diseases</td>
<td>2.1</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>0.8</td>
</tr>
</tbody>
</table>

\(\star\) diabetes

According to the experts, epilepsy in Spain affects between 0.7% and 0.8% of the total population. This means that there are between 320,000 and 368,000 people suffering from epilepsy in Spain (41), of whom some 29,000 are children under the age of 15 (42). However, it is difficult to be precise about these figures since, as in many European countries, no official patient register exists.

Furthermore, epidemiological studies carried out over the last few decades are scarce and present highly varied methodologies and outcomes. Epilepsy prevalence in these studies varies between 4.12 and 18.18 people affected per 1,000 inhabitants whilst active prevalence is between 3.82 and 6.3. As in the rest of Europe, there are no inequalities in the distribution of the disease in the different geographical areas of the country, but there is evidence of greater prevalence in rural areas than in cities and urban areas (43).

The experts stress the need for patient registers to improve care on a national level and to develop the necessary plans for these patients, so as to ensure good diagnosis and treatment and also improve quality of life.

Similarly, there are no studies regarding the prognosis of the disorder in the different age groups, and this considerably limits the prediction of resources and healthcare services for the future and their efficient management. However, bearing in mind the projected demographic growth of older adults and the significant incidence of epilepsy in people over 65 years of age, we predict that the prevalence of the disorder will increase considerably in the next few decades.

In 2016, the Spanish population aged 65 and over was 18.7%. National demographic statistics organizations predict that in 2031, 25.5% of the Spanish population will be over 65 and this will increase up to 34.6% in 2066 (44). Sources also confirm that in Spain there are currently 50,000 people over 65 years of age with epilepsy, approximately 0.6% of the elderly population (7). Based on these data and assuming that the percentage will remain stable in upcoming years, we can estimate that the number of elderly people with epilepsy will rise to 66,000 in 2031 and will continue increasing up to approximately 80,000 in 2066.

Figure 10. Compound annual growth rate (CAGR) of the prevalence of epilepsy in the over 65 population

<table>
<thead>
<tr>
<th>Prognosis of epilepsy prevalence (x 1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
</tr>
<tr>
<td>50</td>
</tr>
</tbody>
</table>

Source: EY analysis based on the National Statistics Institute (INE), Population projections 2016-2066

Key agents of epilepsy at a national level

At present in Spain there are active scientific societies which promote initiatives to improve diagnosis, care and follow up, as well as patient quality of life. In particular, the Spanish Society of Epilepsy (SEEP) has established working groups on the different areas to be improved, including epidemiology, to promote scientific projects of all types in each area (45).

Similarly, the SEN has recently introduced a patient register with SUDEP, to study the causes of epilepsy and design strategies to reduce the potential risks of people with the condition (46). It is also the body responsible for the Spanish register of pregnant women with epilepsy who receive treatment, within the abovementioned international register EURAP.

The following table highlights the main societies which are active in improving healthcare quality in Spain. In addition to those mentioned previously, it also highlights the Spanish Society of Paediatric Neurology (SENEP), whose working group on epilepsy focuses on the clinical care and needs of children suffering with the disorder (47).
### Table 3. Main scientific societies

<table>
<thead>
<tr>
<th>Main objectives and plans of action for epilepsy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spanish Society of Epilepsy</strong></td>
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<td></td>
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<tr>
<td><strong>Spanish Society of Neurology</strong></td>
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<td></td>
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<tr>
<td><strong>Spanish Paediatric Neurology Society</strong></td>
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The Spanish Society of Neurology Nursing (SEDENE) is also outstanding. Its purpose is the development of healthcare for the neurological patient, their family and their environment. It also has a study group dedicated to epilepsy, EPISEDENE (48).

There are also neurology societies in most autonomous communities, among which the Catalan Society of Neurology (SCN) and the Andalusian Society of Epilepsy (SAdE) stand out for their long trajectory in the sector and their constant activity. The SCN is responsible for publishing an official guide on the diagnosis and treatment of neurological disorders, including epilepsy (49), and the SAdE is responsible for publishing clinical practice guidelines on epilepsy, which have been widely accepted in Spain (50). Both societies also have a study group dedicated to epilepsy and share common objectives.

Furthermore, there is a high number of not-for-profit patient and family associations which are fighting to eliminate the social stigma of the disease and promote initiatives to help those affected become integrated into education and the workplace. On a national level, the Spanish Federation of Epilepsy (FEDE), which was recently accepted as the IBE representative in Spain is prominent, since it groups together entities with the common objectives of enhancing the lives of people with epilepsy and their family members. Figure 11 shows the most active associations in Spain and also those which are outstanding in the different autonomous communities. Regions such as Andalusia or Catalonia have up to four associations which are widely active with national results. There are also several patient associations for some of the epilepsy syndromes, e.g. the West Syndrome Foundation and the Landau Kleffner Association in Madrid, the Dravet Support in San Sebastián, the Dravet Foundation and the Chromosome 15q Duplication Investment Foundation.
Figure 11. Main national and regional patient associations

Source: EY analysis
The healthcare blueprint for the patient with epilepsy
4. The healthcare blueprint for the patient with epilepsy

4.1 General overview of care activity

Epilepsy is a complex pathology which requires comprehensive, personalised care, both on a clinical and a social level. Despite this, as yet there is no agreed, standardised strategic plan of approach for the whole of Spain. In several autonomous communities the approach to epilepsy is included in wider healthcare areas, such as the strategic neurology plan in the community of Madrid or the comprehensive care of neurological diseases which may cause disability of the health department of the Government of Catalonia (51).

 Patients with epilepsy are mainly managed by the National Health Service, like the other chronic disorders, although the different regional bodies are in charge of planning and coordinating the different resources and health services to provide their appropriate healthcare. This care is undertaken from low levels of specialisation, such as primary care or neurology services, to high levels of specialisation, such as medical or medical-surgical epilepsy units.

 After a seizure, patients usually go to a primary care centre where they are seen by a family or community doctor, or to the emergency department where they are seen by a neurologist or a paediatrician (52).

 Both primary family and community care or primary paediatric care play a major role, since in many cases they are the initial contact with the patient and refer to other specialists. In Spain, primary care outpatient clinics usually have neurologists, and patients can be referred to them for initial diagnosis and drug treatment (53). If total control of the seizures is successful using the antiepileptic drugs, the patients are again referred to their family and community doctor for follow-up and control of possible adverse effects of medication. However, 80% of primary care doctors acknowledge their little knowledge of epilepsy (51), which in turn prevents them from providing all the necessary information. Against this backdrop, a clear area for improvement in healthcare for epilepsy is the provision of the necessary resources to educate and train other professionals. Furthermore, there are no paediatric neurologists in primary care or in emergency units; this is another clear area for improvement in epilepsy care.

 In contrast, when the type of epilepsy is severe and difficult to control, patients are referred to neurology services or paediatric neurology departments where, in general, they receive more complete care, as they would with other pathologies. Diagnosis, treatment and follow-up of patients is thus essentially carried out in a hospital environment through outpatient consultations, neurology and paediatric neurology departments and specific epilepsy units, depending on the level of specialisation of the hospital in the disorder (51). The neurology and paediatric neurology departments and specific epilepsy units carry out more targeted tests which lead to differential diagnoses, to identify the type of epilepsy and to optimise treatment. It is these units that generally attend to patients with refractory epilepsy and which propose alternative treatments, including surgery.

 Although throughout their care pathway patients may see a great many healthcare professionals of different specialities, the neurologist and paediatric neurologist are in charge of their diagnosis, treatment options and follow-up. Studies confirm that 96% of medical centres have at least one specialist in neurology and over 75% have a neurology department or unit, which functions autonomously in half of cases (53). However, neurologists and paediatric neurologists who specialise in epilepsy, also known as epileptologists, are ideally placed to treat the condition. In Spain, this specialist is available in fewer than 20% of centres, and three out of every four patients are therefore attended by a general or paediatric neurologist (53).

 To sum up, in Spain, the patient with epilepsy may receive care in the following departments, differentiated by the degree of specialisation and availability of resources:

 ▶ Neurology and paediatric neurology departments
 ▶ Epilepsy monographic consultation
 ▶ Epilepsy medical unit
 ▶ Epilepsy medical-surgical unit
 ▶ Complex medical-surgical epilepsy unit
According to the professionals, neurology or paediatric neurology departments are not considered specialist services, although in some cases the centres have specialist clinics exclusively dedicated to the care of the epilepsy patient (monographic consultation). The different units mentioned also have the necessary resources and professionals to offer patients the specialist care they require. The medical units have diagnostic systems and the specialists they need to make a complete diagnosis, whilst the medical-surgical units are sufficiently equipped to manage patients who have been referred for surgery. The complex medical-surgical units in particular are able to offer all types of surgery, including high risk and difficult operations (e.g. hemipherecotomies).

The experts agree that it is vital to promote the training of medical professionals at different levels in treating the disorder and encourage the specialisation of neurologists and paediatric neurologists in the field of epilepsy so as to offer a standardised service to patients throughout Spain.

4.2 Epilepsy specialist centres in Spain

Due to its high prevalence in Spain, an increasing number of units specialising in the pathology are appearing, although medical units and specialists are not yet sufficient to cover all patients without the need to travel long distances. Therefore, practitioners underline the need to extend the network of epilepsy medical units throughout Spain.

As mentioned earlier, the experts stress the need for epilepsy to be treated in specialist units, to ensure a holistic, multidisciplinary approach. They consider that a medical epilepsy unit must provide a complete diagnostic and therapeutic service with access to magnetic resonance imaging with an epilepsy protocol and prolonged video-EEG monitoring within a maximum of 48 hours.

The team must comprise at least two trained epileptologists with a minimum of two years’ experience. The experts also highlight the important role of other specialists, including the nursing team, the neuropsychology team and other additional services. They particularly stress the need for specialist nursing staff to offer optimal and complete patient care, although at present there are few training programmes in epilepsy for nurses.

Figure 12 shows the most important benchmark centres for epilepsy patient care according to their level of specialisation and the availability of healthcare professionals of recognised national and international prestige in epilepsy management. All of these centres have at least two full-time epileptologists. Provinces such as Barcelona or Madrid have more than five public or private centres which specialise in epilepsy. Benchmark units also exist in other regions of Spain such as the Community of Valencia, Galicia, the Basque Country and Andalusia.

Nevertheless, many regions still do not have centres which are able to provide care to these patients. According to a national study, only 35% of public health centres have a specific epilepsy unit and only 7% have a medical-surgical unit (53). As a result, practitioners insist on the development and creation of new medical epilepsy units in the different provinces of the country and on enhancing both the medical units and medical-surgical units already in existence, providing them with all the necessary resources to ensure a complete and comprehensive service.
Figure 12. The most important benchmark centres for epilepsy patient care in Spain

**Public centres**

1. **La Coruña**
   - Complexo Hospitalario U. de Santiago

2. **Bizkaya**
   - Hospital U. de Cruces

3. **Barcelona**
   - Hospital U. Clínic de Barcelona
   - Hospital Sant Joan de Déu
   - Hospital del Mar
   - Hospital Bellvitge
   - Hospital Vall Hebron
   - Hospital Can Ruti

4. **Madrid**
   - Hospital U. de la Princesa
   - Hospital U. de La Paz
   - Hospital Infantil U. Niño Jesús
   - Hospital U. Fundación Jiménez Díaz
   - Hospital San Rafael

5. **Valencia**
   - Hospital U. y Politécnico de la Fe

6. **Málaga**
   - Hospital Regional U. de Málaga

7. **Granada**
   - Hospital U. Virgen de las Nieves

**Private centres**

1. **Barcelona**
   - Hospital Teknon

2. **Madrid**
   - Hospital Ruber Internacional

3. **Sevilla**
   - Centro de Neurología Avanzada

Source: EY analysis
4.3 Diagnosis of the disorder

In general, diagnosis of epilepsy is not a complex process. As we explained earlier, the patient is usually referred for initial diagnosis to a neurologist or paediatric neurologist via primary care or the emergency department. According to the specialists, prompt and accurate diagnosis is key to patient management and prognosis, since it increases the likelihood of controlling the disease.

Diagnosis is essentially based on detailed analysis of the patient’s clinical history and the result of a physical and neurological examination with different diagnostic tests, especially neurophysiological tests (EEG) and neuroimaging (brain MRI).

When a patient is referred to a specialist, the first step is to take a clinical history, which is an essential part of the process of diagnosis. Since medical professionals rarely witness patients’ seizures, the history is based on the descriptions the patients themselves or their family members are able to provide. This process, known as anamnesis, consists of collecting data and information by asking specific questions regarding the characteristics of the seizures and other information about the patient’s personal and family background. Some important data on the seizures are: duration, circumstances in which they took place, how they affected consciousness, the appearance of motor, sensitive, sensory symptoms or those related to speech, and the recovery after the seizure (6).

Once the clinical history has been taken, different physical examination tests are usually performed, which are chosen by the neurologist or paediatric neurologist based on the history and the availability of the tests. In special cases, when the patient has presented at the emergency department and there is the possibility of a brain injury, computed axial tomography is recommended (CAT) to assess for trauma or other structural epileptogenic focus as a cause of the seizure, even if a full clinical history has not been taken.
Table 4. Main diagnostic tests based on physical, cerebral, genetic and psychological examination in patients with epilepsy

<table>
<thead>
<tr>
<th>Test</th>
<th>Purpose</th>
<th>Specific tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General analyses</strong></td>
<td>• Assess the adverse effects of antiepileptic drugs</td>
<td>• Blood test</td>
</tr>
<tr>
<td></td>
<td>• Rule out metabolic changes</td>
<td>• Urine test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cerebrospinal fluid analysis</td>
</tr>
<tr>
<td><strong>Neurological electrophysiology tests</strong></td>
<td>• Detect epileptiform anomalies (anomalous neuronal discharges)</td>
<td>• Basal EEG</td>
</tr>
<tr>
<td></td>
<td>• Identify possible triggers of epileptic seizures</td>
<td>• Basal EEG during sleep</td>
</tr>
<tr>
<td></td>
<td>• Confirm and classify epilepsy</td>
<td>• Sleep-deprived EEG</td>
</tr>
<tr>
<td></td>
<td>• Identify syndromes</td>
<td>• Short EEG video</td>
</tr>
<tr>
<td></td>
<td>• Locate epileptic focus</td>
<td>• Long EEG video</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Holter EEG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EEG with stimulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Polysomnography</td>
</tr>
<tr>
<td><strong>Brain imaging tests</strong></td>
<td>• Identify a structural lesion</td>
<td>• Brain MRI</td>
</tr>
<tr>
<td></td>
<td>• Locate the epileptic focus</td>
<td>• Brain CAT/CT scan</td>
</tr>
<tr>
<td></td>
<td>• Preoperative assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Assess the changes in the epileptic seizure pattern</td>
<td></td>
</tr>
<tr>
<td><strong>Functional brain imaging tests</strong></td>
<td>• Conform the epileptogenic focus</td>
<td>• Brain SPECT scan</td>
</tr>
<tr>
<td></td>
<td>• Evaluate surgical treatment</td>
<td>• Brain PET scan</td>
</tr>
<tr>
<td></td>
<td>• Assess the risk of postoperative sequelae</td>
<td>• Functional brain MRI</td>
</tr>
<tr>
<td></td>
<td>• Assess the viability of invasive EEG</td>
<td></td>
</tr>
<tr>
<td><strong>Genetic tests</strong></td>
<td>• Specific epilepsy diagnosis reached associated with genetic cause</td>
<td>• There are different tests to assess different genetic substrata</td>
</tr>
<tr>
<td><strong>Neuropsychological tests</strong></td>
<td>• Assess cognitive, behavioural and emotional changes</td>
<td>• Attention/concentration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Learning and memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual-spatial and visual-perceptive skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Executive functions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Overall intellect</td>
</tr>
<tr>
<td><strong>Other tests</strong></td>
<td>• Complement or help to rule out associated disorders</td>
<td>• Electrocardiogram</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Autoimmunity studies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Metabolic studies</td>
</tr>
</tbody>
</table>

It is worth noting that the physical test results are normal for many patients, and therefore diagnosis is exclusively based on the patient’s clinical history (6). Table 4 details the main diagnostic tests to complement the patient’s history, together with their specific objectives and modalities.

As the Table shows, there are a great many tests for diagnosing epilepsy, and a particularly wide variety of tests based on the encephalogram (EEG). These involve monitoring the electrical activity of the brain in a baseline state or under specific circumstances. These recordings can identify the triggers of the seizures, and even classify the epilepsy, but have limitations since an anomalous brain activity may occur in people who have no type of epilepsy, whilst those who are affected may show normal brain activity. (6). The experts highlight the usefulness of prolonged video-EEG in monitoring epileptic seizures and locating the area of the brain from which they originate (50).

Furthermore, neuroimaging techniques have evolved exponentially in recent years, acquiring an increasingly important role in the diagnosis of epilepsy, because they can locate the epileptic focus or any structural lesions causing the seizures.

The specialists agree that if the appropriate tests are performed, promptly epilepsy is easy to diagnose. However, long waiting lists for basic diagnostic tests delay the process in many cases. According to the results of national surveys in medical centres, access to the great majority of these tests is limited, and many epilepsy units are forced to use other units or even other hospitals. Video EEGs and high definition neuroimaging tests are less available and have the longest waiting lists (53). In this context, increasing accessibility to the main tests and reducing mean waiting times are major challenges for improving epilepsy care.

The importance of genetic tests has also increased in recent years in the diagnosis and identification of epileptic syndromes. Several syndromes such as Dravet syndrome are strongly linked to changes in specific genes, and genetic testing is therefore sufficient for diagnosing the disorder (4), (49), (50). However, these tests are very expensive, and access to them is usually extremely limited for the majority of patients.

Lastly, we should consider that patients with epilepsy, not only have to cope with seizures and their consequences but in many cases also have cognitive or psychosocial problems. For this reason, there are other neuropsychological tests to assess possible changes in the cognitive, behavioural or emotional areas listed in Table 4 (54).

In the diagnosis of epilepsy, it is essential that patients receive all the information they require and are taught to manage the disorder well. Specialist epilepsy units in Spain currently receive a large volume of patients, and neurologists, paediatric neurologists or epileptologists are unable to provide patients with personalised information and teaching. In the light of this, the specialists emphasize the importance of specialist training for nurses and increasing their presence in this area so that they can take on the role of raising patient awareness and train them in the optimal management of their condition.

### Diagnostic studies of brain imaging

The two most frequently used techniques in Spanish hospitals are magnetic resonance (MR) and computed tomography (CT) (6). CT examination, which has been included in routine emergency service diagnosis, rules out brain damage, but it is no substitute for MR which provides a complete diagnosis with which the cause or possible epileptic syndromes may be identified (49), (50). It is of note that these tests are not essential in cases of epilepsy with typical presentation and of benign character, such as childhood absence epilepsy, childhood/teenage myoclonic epilepsy or benign rolandic epilepsy (6), (49).

Other differential diagnostic tests, such as positron emission tomography (PET), simple photon emission computed tomography or functional MR are indicated to assess the viability of surgery for treatment of the disorder in some cases, but are not necessary for the management of the remainder of patients (6), (49), (50). For example, PET tests are highly sensitive in the diagnosis of temporal lobe epilepsy (56).

### 4.4 The treatment

The main goal of epilepsy treatment is the remission of seizures with the fewest adverse effects possible, thus enhancing the patients’ quality of life.

Neurologists, paediatric neurologists or epileptologists will choose from a large variety of treatments, depending on the patient’s characteristics, type of epilepsy and its clinical course. There are 4 major treatment groups depending on the nature and principle of action:

- Pharmacological treatment
- Surgical treatment
- Stimulation of the vagus nerve or neuro stimulation
- Ketogenic diet

#### 4.4.1. Pharmacological treatment

When a patient has been diagnosed with epilepsy, monotherapy is usually administered with one antiepileptic drug (AED). This is the gold standard for epilepsy, since the disorder can be controlled in 70% of cases (3) (4) (6). Although there are many AED options (50), the type of drug prescribed varies depending on the type of epilepsy diagnosed and the physical and clinical characteristics of the patient, such as age, gender, weight or clinical history (6). In addition, among a similar effectiveness, the AED of choice would be that with less side effects, fewer interactions, greater
ease of use and with a faster onset of action and providing a better cognitive and behavioral profile, characteristics that bring together, to a greater extent, therapeutic innovations.

AED usually have very diverse side effects, both short and long term. The most common are sleepiness, lack of concentration and dizziness, although others can be more serious, such as allergic reactions. Some of the effects can be chronic, such as weight fluctuations, gum inflammation, kidney problems or cognitive changes (6). The aim of the healthcare professional is therefore to find the ideal drug for each patient according to their characteristics, which enhances the efficacy of treatment and minimises side effects (4). As previously mentioned, the drugs that meet most of these characteristics are, mainly, the latest therapeutic innovations.

If monotherapy is unsuccessful in controlling the seizures effectively, a combined therapy of two or more AEDs should be initiated. Patients often have to try more than one drug option, before gaining effective control of their seizures. According to the experts, there is a 50% probability of achieving remission of seizures with the initial treatment prescribed, whilst the likelihood of remission after the second treatment option falls by over a half to 20%. Following a third treatment option, the likelihood of remission falls drastically, to below 5% and the probability of refractory epilepsy therefore increases.

If patients are not successful in controlling all their seizures with any drug combinations, they are considered to suffer from refractory epilepsy and are then usually referred to medical centres specialising in epilepsy, where a much more specialist diagnosis can be made and alternative treatment options proposed.

4.4.2. Surgical treatment
Surgery is the best treatment option for some patients with refractory epilepsy, particularly those with focal epilepsy with a well-located lesion (4) (6).

Patients with refractory epilepsy of this type are assessed in the medical surgical unit to locate the epileptogenic area and examine the viability of operating, by assessing the risk of brain damage. Here, the neuropsychologist in the medical-surgical unit is playing an increasing role, since they perform pre- and postoperative examinations of neurological, cognitive and emotional functions to detect whether patients are suffering from major changes before and/or after the operation, establishing high-risk profiles for damage to these skills (50) (55).

Some operations seek to suppress the seizures, i.e. to eliminate the brain focus where the epileptic seizure starts, whilst others are palliative since they simply reduce the number of seizures or modify the propagation features. It is noteworthy that only 5%-10% of refractory patients are candidates for surgery, of whom an even lower percentage are operated.

The rate of success of surgical treatment varies according to each case and type of operation. Techniques such as amygdalohippocampectomy or corpus callosum section are successful in over 70% of cases, whilst several cortical resections applied to neocortical epilepsies with no single identified lesions, have poorer outcomes (4), (50).

The four surgical techniques used to treat epilepsy

- **Cortical resection:** Several different cortical resection techniques are in use today, aimed at removing the cerebral substratum responsible for the epileptic seizures. Of these, temporal lobectomy with amygdalohippocampectomy is the most widely used procedure in epilepsy surgery and is indicated for medial temporal lobe epilepsies.

- **Hemispherectomy and wide multilobular resections:** These consist of partial removal and partial disconnection of the affected tissue. This technique is generally indicated in patients who have suffered during the perinatal period or in childhood from traumatic, inflammatory, degenerative or congenital type processes which present with hemiplegia.

- **Corpus callosum section:** A palliative technique in patients with severe epilepsies, in which it is impossible to identify a single epileptic focus. It consists in changing the seizure propagation without removing the epileptic focus, providing a major improvement in the patient’s quality of life. This type of procedure is indicated for people who suffer from severe syndromes such as Lennox-Gastaut syndrome.

- **Deleterious stereotactic techniques:** These consist of destroying the areas responsible for the epileptic discharges or harming the propagation pathways, thereby lessening seizures. They are carried out in very severe cases of generalised epilepsies which cannot be treated with the before-mentioned surgical treatments (6), (57).

4.4.3 Stimulation of the vagus nerve or neurostimulation
There are other forms of alternative clinical treatment based on stimulation of the vagus nerve or neurostimulation, which are only applied when all other previous treatment options have not been successful, since they are costly and require the intervention of an expert surgeon (6).

Vagus nerve stimulation consists of the introduction of an electrode into the left vagus nerve connected to a subcutaneous generator, which emits electric impulses, stimulating the nerve in question. The aim of this procedure is to reduce the frequency and severity of certain types of partial seizures and drop attacks (50), (56). According to several clinical studies, 50% of patients who...
receive this type of treatment successfully reduce their seizures and under 5% become completely seizure free (57).

Deep brain stimulation can also be used for the most severe types of epilepsy which are resistant to drugs. This consists of stimulating the subcortical structures. Recent studies have observed a considerable reduction in seizures and their frequency in 50% of cases in which one of the types of deep brain stimulation were performed (58). Neurostimulation has not yet been approved by the European Medicines Agency for the treatment of epilepsy (although it has been approved for other neurological diseases), and it can therefore only be used in experimental procedures.

4.4.4 Ketogenic diet

The ketogenic diet is one of the oldest therapies for patients with epilepsy, although with the development of effective antiepileptic drugs it is used less often and has become a secondary treatment option (4).

This diet consists of replacing carbohydrates with fats, i.e. fats become the main source of energy. The exact mechanisms involved are unknown although the experts believe that this diet may stimulate the synthesis of neurotransmitters which regulate the potential of the neuronal membrane (4). However, this treatment can have gastrointestinal side effects or biochemical alterations which should be monitored. For this reason, when a patient starts this type of treatment, they should be hospitalised, since the diet has to be adopted gradually, under the supervision of a nutritionist (4).

Efficacy studies indicate that half of the children who start this diet experience a 50% reduction in epileptic seizures after 3 to 6 months (58), (59). Expert paediatric neurologists also increasingly recommend this diet to patients with refractory epilepsies and highlight its efficacy in the control of childhood epilepsy (50).

4.5 Patient control and follow-up

Once treatment has been administrated, follow-up of the disease and the patient’s progress at different levels is carried out. Clinical controls are of vital importance for assessing the effectiveness of treatment and for assessing the patient’s general condition (4). Furthermore, the experts recommend that the patient records any seizures and the side effects of medication.

The primary care doctor must get involved in the general long-term control and follow-up of the patient, as well as the monitoring of seizures and the control of side effects from medication (52). In addition, the neurologists, paediatric neurologists or epileptologists are responsible for the follow-up of epilepsy patients, for monitoring response to treatment and assessing the reduction or remission of the seizures. If necessary, they can gradually change dose, or modify the drug therapy to obtain optimum treatment for the patient. As previously stated, accurate drug therapy, together with a healthy lifestyle will successfully control epilepsy in over 70% of patients.

However, drug treatment can be withdrawn from specific patients who have not suffered a seizure for a period of between two and five years, depending on the epileptic syndrome and according to the epileptologist’s judgment. The withdrawal of AED is carried out progressively for a period of up to several months with EEG recordings (60), (49). However, the proportion of patients with relapse after withdrawing drug therapy is almost 40% (49).

In patient follow-up, support from complementary services such as psychologists or social services is of great importance. Their intervention will depend on the severity of the illness and the situation of each patient. Although nowadays psychosocial services play a secondary role in healthcare, all the agents agree that it is important to increase them and make them accessible to all patients, since they are vital for confronting potential psychopathological changes associated with the disorder, such as depression, aggressiveness, personality changes or lack of social skills, thus contributing to a better quality of life for the patient and their family members (61). The experts highlight that good patient follow-up is essential, since epilepsy is currently the second cause of neurological emergencies in adults, just after stroke. For this reason the “código crisis” (seizure code) has been put into place in several hospitals, with the main goal of reducing action times for epileptic seizures, since delay in starting treatment to control them leads to poorer patient prognosis (62).

Furthermore, the control and follow-up of epilepsy is vital in women, since this pathology has an effect on the menstrual cycle, pregnancy and breastfeeding (6). For this reason, women, especially those who are of child bearing age and are contemplating pregnancy, should increase their visits to the specialist for more thorough control and follow-up. There are certain pharmacological treatments which have negative effects on foetal development and others which may interfere with the effectiveness of certain oral contraceptives. Closer follow-up is therefore required, by the neurologist and the other key agents involved, such as the primary care physician and the gynaecologist (63).

It is also important to highlight the importance of a healthy lifestyle, a healthy diet, practising sport or activities such as yoga, and enough rest. These factors are essential for a good quality of life and in preventing seizures to the extent possible.

Figure 13 below shows the healthcare pathway of patients with epilepsy from their first seizures when they are seen by the healthcare professionals until they receive medical treatment and follow-up.
Figure 13. Healthcare pathway of the patient with epilepsy

PC: Primary care; AED: Antiepileptic drug; ES: Epileptic seizure; Encephalography SPECT: Monophotonic emission computed tomography
Childhood epilepsy care in Spain

Of all the people who have epilepsy, children and teenagers are one of the most important and vulnerable sectors of the population. According to several sources, 40% of epilepsies are diagnosed in children under the age of 15 (7). The experts also stress that over three quarters of the children who present at emergency departments with neurological symptoms are diagnosed with epilepsy; it is therefore one of the major neurological disorders in children.

Studies on children and teenagers have reported a mean incidence of around 63 cases per 100,000 inhabitants (64), (65), peaking during the first year of life (95.3 cases per 100,000) and gradually decreasing until adolescence (48.7 cases per 100,000) (65).

The total number of children with epilepsy in Spain today is unknown. As previously stated, epidemiological studies on the prevalence and incidence of this disorder are scarce and report highly varied figures. Furthermore, there is no current epidemiological study of the prevalence of childhood epilepsy in Spain, although several sources consider that approximately 29,000 children suffer from epilepsy (42). However, paediatric neurologists believe that the prevalence could be much higher and they stress the need for registers and/or epidemiological studies to reliably estimate the number of children affected and establish the most prevalent aetiologies and symptoms.

According to the experts, although the cause of the disease is unknown in many children with epilepsy, the majority of cases are of genetic cause or due to congenital metabolic diseases. Other structural causes include trauma, malformations, tumours or infections of the central nervous system (6).

The paediatric neurologist who specialises in epilepsy is the most appropriate practitioner to manage epilepsy in children under the age of 18. However, it is the non-specialist paediatric neurologists who usually manage the diagnosis, treatment and follow-up of children with epilepsy, and of patients of other ages. In Spain, the specialist paediatric neurology centres that offer comprehensive care to children and teenagers under the age of 18 are few and far between. The Hospital Sant Joan de Déu (Barcelona), the Hospital del Niño Jesús (Madrid), the Hospital Universitario Virgen de las Nieves (Granada) and the Hospital Universitario y Politécnico de La Fe (Valencia) are the benchmark centres with the highest activity in paediatric epilepsy management. Although these four hospitals accept large volumes of patients per year, the experts point out the lack of specialist paediatric neurologists and medical epilepsy units for the treatment of childhood epilepsy.

Diagnosing and treating epilepsy in children is not very different in practice to epilepsy in adults. A detailed and well-structured clinical history is necessary, based on the patient's background and that of their family. This information is generally provided by the patients' parents. The abovementioned complementary physical examination tests are also performed, such as the different EEG modalities or other neuroimaging tests. However, the experts consider that genetic and metabolic tests are the most appropriate for identifying specific syndromes and other epilepsies, although in the majority of centres access to them is difficult.

As previously stated, there is a broad variety of types of epilepsy which can be diagnosed at different times of life, i.e. during breastfeeding, childhood and adolescence. According to the experts, benign epilepsy with centrotemporal spikes, also known as rolandic epilepsy, is the most common of all the childhood epilepsies, affecting 30% of children with epilepsy. Other common epilepsies and syndromes include childhood absence seizures, teenage myoclonic epilepsy, Lennoux-Gastaut syndrome and West syndrome.

In common with adults, the treatment prescribed by the paediatric neurologist or neurologist will depend on the type of epilepsy diagnosed and other variables. The majority of patients are treated pharmacologically, although according to the experts, surgery and other alternative treatments have proven to have more favourable outcomes in children than in adults. They state that the success rate of surgery is higher in paediatric patients than in adults and generally parents and family members are more willing to accept this type of treatment.

The experts also highlight the efficacy of vagus nerve stimulation, which reduces the frequency of seizures by half in 30% of cases, and the ketogenic diet that significantly reduces the intensity and frequency of seizures by 60%, between 15%-20% of patients remain seizure free (59).

According to the experts, the prognosis of the disorder varies greatly, depending on the type of epilepsy, syndrome and aetiology. Moreover, there are some forms of self-limiting epilepsies that start during the neonatal period, during breastfeeding or school age and disappear during puberty. These epilepsies, which are considered benign, generally have a favourable prognosis and comprise almost 60% of childhood epilepsies (5).

There are other much more severe forms of epilepsy which are drug resistant and could be associated with delayed cognitive development. According to the professionals, the most severe forms of epilepsy appear before the child is three, and 40% of them are refractory. Studies also indicate that 14% of children with epilepsy suffer from some type of mental impairment (66). Studies also show that epilepsy is associated with other types of disorders, such as autism, since 30% of autistic children suffer from some form of epilepsy (67).

Although the diagnosis and treatment of childhood epilepsy is not very different from that of adults who suffer from the disease, psychosocial practices and the professionals involved in patient follow-up do differ. Schooling and social integration are two major challenges which children and teenagers with epilepsy and their families must face. Paediatric neurologists point out that although between 60% and 70% of children with epilepsy have a normal IQ (66), 40% suffer from learning difficulties and are at greater risk of
developing ADHD⁵ (68). According to the experts, up to 30% of children with epilepsy are diagnosed with ADHD. Support from childhood psychologists, school teachers and family members is therefore essential for the intellectual and emotional development of the patient and to ensure good school performance which will result in improved long-term quality of life.

Social stigma, fear and lack of knowledge about epilepsy can lead to rejection at school, making it difficult for the affected children to integrate properly and leading to problems of self esteem, especially in adolescence when patients are more concerned by society’s opinion of the disorder. Also, although the parents are responsible for managing the disorder and adherence to treatment during childhood, problems can occur in puberty. It is therefore vital that these young patients are well informed to reduce potential consequences.

It is essential to ensure appropriate, high quality, uninterrupted healthcare at each stage of development from adolescence to adulthood. According to the experts, there is still a long way to go given the lack of a standardised protocol for specialists, patients and their families on how to approach this transitional period between childhood and maturity.

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⁵ Attention deficit disorder with or without hyperactivity
5 The impact of epilepsy
5. The impact of epilepsy

Epilepsy has a high social and psychological impact on patients due to stigmatisation, treatment and other underlying difficulties of the disorder. It also implies a heavy financial burden for health systems due to its high associated expenses.

It is worth mentioning that the financial impact varies, depending on whether the patients respond to medication (70%) or are refractory (30%) (3), (69). The negative consequences on quality of life and financial costs are greater in patients who do not respond to drugs. This study examines the general impact on all types of patients and the following sections address the personal, social and financial impact.

5.1. Social and personal impact

This disorder affects the social and personal life of the patient as a consequence of the different factors listed below, which particularly impact quality of life.

- Discrimination and stigma
- Employment and financial consequences
- Medical treatment and its adverse effects
- Other effects of the disorder

In ancient times, epilepsy was associated with divine forces and viewed with fear. Although this vision of epilepsy is now a thing of the past, there are still strong prejudices in society due to a lack of education. The disorder is commonly associated with stigma and discrimination, and these factors have a huge impact on family, educational and professional environments. There can be grave consequences for children (discrimination at school, cognitive difficulties and social maladjustment), and for adults (fewer romantic relationships and fewer offspring, problems with social relationships and discrimination in the workplace) (20).

This discrimination at work affects employed patients and those seeking employment, because their disorder makes it more difficult to find work, and the jobs they find are often less well paid. Discrimination at school and the effects of the disorder may result in academic failure which may also lead to a higher rate of unemployment and lower salaries (20). This all leads to financial problems, particularly for patients who have to bear financial costs due to the disorder (70).

Drug-related adverse effects also have a direct impact on the everyday and professional life of patients (20), as do their repeated follow-up visits. Some patients are also hospitalised at some point and in the most severe cases, have to undergo surgery or other aggressive treatments such as the ketogenic diet (71).

All these factors reduce the quality of life of the patient, as do other consequences such as:

- Possibility of neurological and systemic diseases (20)
- Recurrent epileptic seizures in refractory patients (20)
- Absence from work, up to 146 days in 11.1% of employed patients (70)
- Need for paid carers for some adult patients (69)
- Need to care for children or other ill family members (20), (72) (73)
- Mortality rate 2 or 3 times higher than that of the general population (20), (21)
- Possibility of sudden death (SUDEP) (74)
- Difficulties obtaining a driving licence (41)
- Need to be declared permanently unable to work in the most severe cases (75), (76)

Although all of the above factors derive directly from the disorder and have an impact on the patient’s quality of life and that of their family members or carers, the experts agree that the last four are of particular concern. The possibility of sudden death from unknown causes (known as SUDEP) has a great impact on patients, and accounts for 2%-18% of total deaths in epilepsy. There is also a high rate of mortality compared to that of the general population (24).

Being unable to work also has a huge effect on patients (currently estimated to be 12.5% of the total number of patients (75)) and having to be declared permanently unable to work by the State is not easy for patients in these times (76). Furthermore, the experts state that refractory patients should automatically be offered this option. Finally, the difficulty in obtaining a driving licence also has a great impact, since according to one study only 35.7% of patients have a licence (69), and this affects their independence and mobility. Furthermore, professional drivers are no longer allowed to hold a driving licence and are forced to give up their occupation.

The total impact of the disorder affects quality of life and forms a part of the so-called intangible costs, which are impossible to quantify. However, several indicators determine the perception of quality of life, e.g. the QOLIE-31 (77) questionnaire and its abbreviated version, the QOLIE-10 (78). In a study of adults treated with 2 or more AED, the QOLIE-31 questionnaire resulted in a global score of 60.4 out of 100, with a mean value of 70.8 for responders compared with a mean value of 56.4 for refractory patients (69). In other words, refractory epilepsy has a much greater impact on quality of life than epilepsy which has been controlled with drugs.
In this same study, the general quality of life questionnaire EQ-5D-3L (79) was used with results of 75.6 for responders and 64.7 for drug-resistant patients. These results when compared with other highly prevalent chronic diseases such as HIV, Alzheimer’s disease or stroke6, at 71.14, 40.98 and 53.69, respectively, show that refractory patients have a lower perception of quality of life than patients with HIV, but higher than patients with Alzheimer’s disease and stroke. Compared with the perception of the general healthy population, with a score of 85.1 out of 100, all the people who suffer from this type of disorder consider that they have a lower quality of life (80).

Furthermore, these studies suggest that repeated seizures have long-term impact on cognitive functions, depending on the duration of the disorder, the frequency and type of seizures (81). However, no studies establish a relationship between the time and frequency of epileptic seizures and changes in cognitive ability.

All aggravating circumstances in the life of the epilepsy patient can trigger physical problems, such as the consequence of falls during seizures, and psychological disorders such as depression, anxiety and psychosis (6), (82). The NDDI-E (83) questionnaire, used in the study with patients treated with 2 AED or more, demonstrated a mean presence of depression of 12.3 out of 100, which was much higher in the refractory patients (23/100), than in the responders (8.3/100) (69).

Lastly, for paediatric patients, there are scales to evaluate the quality of life of the child with epilepsy: (CAVE) and QOLCE (Quality of Life in Childhood Epilepsy Questionnaire) (84).

Based on these results, one of the challenges posed by epilepsy today is the promotion of complementary services of neuropsychology, psychiatry and other state support services, as their role in patient supervision throughout the treatment process is crucial. At present, the experts stress that this assistance is almost nonexistent, and patients have no access to the professionals they need to treat them and help them cope with their disorder.

**Quality of life questionnaires**

Health-related quality of life questionnaires (HRQOL) are tools used to study the health of the population and analyze the efficacy and effectiveness of health interventions.

They contain questions on the perception of different aspects relating to quality of life and may be targeted at the population at large or patient groups with different pathologies.

They are used in many healthcare studies today and must therefore be questionnaires of solid design, quick and simple to respond to, and with valid and reliably obtained results.

Although the most common occurrence is that the patients themselves complete the questionnaire, i.e. read it and respond to it with their own interpretation, it may also be completed as a personal or telephone interview.

Questionnaires QOLIE-31 and QOLIE-10 are specific quality of life questionnaires for patients with epilepsy. Questionnaire CAVE is for children of paediatric care age. EQ-5D is also a quality of life questionnaire but it is generic, for different types of disease. Lastly, NDDI-E is aimed at detecting depression in patients with epilepsy.

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6 Clinical syndrome of rapid onset caused by a focal perturbation of brain function, of vascular origin and lasting longer than 24 hours. Other terms are: apoplexy, brain attack, brain haemorrhage and cerebral infarction
5.2 Financial impact

The major prevalence and chronicity of epilepsy entails extremely high costs either directly through medical treatment of the patients, or indirectly with expenses which are not covered under healthcare budgets. These non-healthcare costs are relevant due to the high rates of loss of both temporary and permanent productivity from patients.

As previously stated, there is a huge difference in impact between patients who respond to treatment and those who do not. This study shows overall costs of the disorder, taking into account that responders comprised 70% of the total patients and refractory patients the remaining 30%, although some costs, such as that of sick leave are only taken into consideration for the refractory patients.

It is also of note, as with the epidemiological data, that few studies have been conducted on the financial impact of epilepsy in Spain, and those that do exist were conducted many years ago.

The financial impact is broken down into the following costs:

- Healthcare
- Non-healthcare
- Loss of employment productivity
- Paid by the patient

5.2.1 Healthcare costs

The healthcare costs of a disorder combine all expenses related to patient care, such as the costs associated with visits to the doctor, diagnostic tests, hospital stays and medication.

As the reference for healthcare costs, this report used a national study on adult patients treated with a minimum of 2 AED, and extrapolated the result to the whole population. Although the experts stress that approximately 60% of all patients are treated with 1 AED, this study is considered a good reference for cost calculation.

The estimates for this calculation take as reference the prevalence data provided by the experts: a prevalence of between 0.7% and 0.8%, implying a total of approximately 345,000 people affected by epilepsy in Spain, including minors and adults. Costs per patient and total costs are listed below:

<table>
<thead>
<tr>
<th>Concept</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacological treatments</td>
<td>3,039 €</td>
</tr>
<tr>
<td>Hospitalisations and surgical interventions</td>
<td>621 €</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>120 €</td>
</tr>
<tr>
<td>Visits to neurologists</td>
<td>176 €</td>
</tr>
<tr>
<td>Emergency services and primary care</td>
<td>81 €</td>
</tr>
<tr>
<td>Visits to other specialists</td>
<td>36 €</td>
</tr>
<tr>
<td>Annual healthcare costs per patient</td>
<td>4,073 €</td>
</tr>
<tr>
<td>Total healthcare costs (345,000 patients)</td>
<td>1,405,185,000 €</td>
</tr>
</tbody>
</table>


It has been estimated that the mean direct annual costs per treated patient are 4,073 €. Therefore, the total annual healthcare cost of epilepsy in Spain is around 1,405 million euros.

Although there is no published data that evidences this, clinical experts point out that the choice of certain pharmacological treatments (such as, for example, inducing AEDs versus non-inducing AEDs) could have implications for associated comorbidities and direct health costs.

5.2.2 Non-healthcare costs

Non-healthcare costs are those associated with care and assistance outside the hospital. These costs include, for example, visits to the psychologist, salaried carers, special needs education for children, and rehabilitation.

To calculate these costs a distinction between adults and children was made since the latter require more care and attention, especially with regards to psychological treatment and social integration.

For the calculation of non-healthcare costs for adults, the same study as for the healthcare costs was used (69), taking into account the indicator of salaried carers, since no additional information exists for other types of services. On the other hand, to estimate the costs for children, a study was used that specified the non-healthcare costs of special needs education and support classes, together with those of private teachers, psychologists and speech therapists, rehabilitation and stimulation (72).

Taking into account the total prevalence of 345,000, and the prevalence in children up to the age of 15 at approximately 29,000, the prevalence for patients over 15 is estimated at 316,000. With these data, the total non-healthcare cost is approximately 369 million euros. Below is a breakdown of the non-healthcare cost calculations:
Table 6. Total annual non-healthcare costs

<table>
<thead>
<tr>
<th>Concept</th>
<th>Nº patients</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carers for &gt;15 years of age</td>
<td>316,000</td>
<td>1,008 €</td>
</tr>
<tr>
<td>Services for &lt;15 years of age (special needs education, psychologists, etc.)</td>
<td>29,000</td>
<td>1,745 €</td>
</tr>
<tr>
<td><strong>Total non healthcare costs (millions)</strong></td>
<td><strong>369,133,000 €</strong></td>
<td></td>
</tr>
</tbody>
</table>


5.2.3 Costs due to loss of labour productivity

Costs associated with loss of labour derive from the patient’s loss of productivity due to the illness. These costs may be classified into the following causes:

- Temporary sick leave
- Permanent occupational disability
- Sick leave for child care

Taking as the reference the current population and employment data in Spain, together with information on national studies which address this issue, it is estimated that the total cost of labour losses amounts to 960 million euros, as shown in the following table:

Table 7. Annual cost of labour losses

<table>
<thead>
<tr>
<th>Concept</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporarily sick leave</td>
<td>43,058,478 €</td>
</tr>
<tr>
<td>Permanent occupational disability</td>
<td>904,024,598 €</td>
</tr>
<tr>
<td>Sick leave due to caring for minors</td>
<td>13,031,730 €</td>
</tr>
<tr>
<td><strong>Total costs of labour losses</strong></td>
<td><strong>960,114,806 €</strong></td>
</tr>
</tbody>
</table>


We will now address each of the abovementioned costs separately.

Temporary sick leave

As previously stated, epilepsy has a great impact on the patient’s quality of life and may also affect their working life. Epileptic seizures which prevent a patient going to work, adverse effects of medication and other factors such as visits to the doctor during working hours can all result in the patient being unable to work.

Only patients aged over 16 were taken into consideration for this calculation. Their prevalence is 313,000. Adult prevalence was used for patients over 15 years of age, and with refractory epilepsy (30% of the total), since patients with controlled seizures generally lead a completely normal life. It is estimated that of these patients, 44.7% are employed (75), with 11.1% of them taking sick leave of up to 73 days every 6 months (70).

The average salaries of both men and women were used for the annual gross salary in Spain, which is 23,106 € (85). This is because the differences in prevalence by gender are usually minimal (86). Although some studies indicate that the prevalence is slightly higher in men than women. This is the case of a study conducted in primary care in a health centre in Oviedo, where a male prevalence of 52.6% and a female prevalence of 47.4% was obtained (87). Furthermore, the employment data of epilepsy patients by age range would be needed to obtain the most precise result, but no studies have been undertaken as yet to provide this information.

The total cost due to temporary sick leave has been estimated at 43 million euros, based on the annual gross salary in Spain and the number of employees with refractory epilepsy (MRE) leading to temporary absence from work.
Table 8. Total cost for temporary sick leave

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (&gt; 16 years of age) with MRE</td>
<td>93,900</td>
</tr>
<tr>
<td>Employment rate of people with MRE</td>
<td>44.70 %</td>
</tr>
<tr>
<td>Estimated number of employees with MRE</td>
<td>41,973</td>
</tr>
<tr>
<td>Percentage of patients employed it causes to have sick leave</td>
<td>11.1 %</td>
</tr>
<tr>
<td>Employees with MRE which causes sick leave</td>
<td>4,659</td>
</tr>
<tr>
<td>Days of sick leave used by employees with MRE</td>
<td>146</td>
</tr>
<tr>
<td>Mean daily salary in Spain (2015)</td>
<td>63.3 €</td>
</tr>
<tr>
<td>Annual cost of temporary sick leave of employee with MRE</td>
<td>9,242 €</td>
</tr>
<tr>
<td>Total annual cost of temporary sick leave</td>
<td>43,058,478 €</td>
</tr>
</tbody>
</table>


Costs caused by presenteeism (loss of productivity due to working when sick) have not been included in the calculation of these costs, although it is estimated that they could be high for this type of pathology.

Permanent occupational disability

In addition to temporary absences from work, epilepsy may have severe consequences for patients, such as the need to be granted permanent occupational disability. Although the percentage of patients with occupational disability is higher in the case of refractory epilepsy than that controlled with drugs, 23.9% compared with 8%, the mean is approximately 12.5% of all adult patients (75). Bearing these data in mind and the abovementioned mean gross annual salary in Spain, it is estimated that the cost for permanent occupational disability is around 904 million euros.

Table 9. Total annual cost for permanent occupational disability

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean annual salary in Spain (2015)</td>
<td>23,106,06 €</td>
</tr>
<tr>
<td>Patients (&gt; 16 years of age) with epilepsy</td>
<td>313,000</td>
</tr>
<tr>
<td>Percentage of patients occupationally disabled</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Loss of employees from disability</td>
<td>39,125</td>
</tr>
<tr>
<td>Total permanent incapacities</td>
<td>904,024,598 €</td>
</tr>
</tbody>
</table>

Source: EY analysis based on Marinas A, et al., “Socio-occupational and employment profile of patients with epilepsy”, Epilepsy & Behaviour, 2011; and National Statistics Institute

Although the total costs of this study were estimated from a social perspective, we should also mention the costs paid by the State (Government perspective) for disability pensions, which using the minimum annual amount due to common illness amounting to 5,566,4 € (88), totals 217,785,400 euros. This sum is not included in the total financial cost of the illness since it is of direct benefit to the patient with occupational disability.

Sick leave due to caring for minors

The cost for loss of productivity of the employed refractory patient has already been estimated above, but caring for minors is another reason associated with epilepsy for adult absence from work. When a child falls ill due to epilepsy and needs the care of his/her parents or a close family member, loss of productivity occurs when it is impossible for the caregiver to go to work.

Taking the prevalence of children in Spain and the total indirect cost from a study on childhood epilepsy in Spain that only took into consideration the cost for loss of the carer’s productivity, the cost due to sick leave to care for a minor amounts to approximately 13 million euros annually (72).

Table 10. Total annual cost for sick leave due to caring for minors

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (&lt; 15 years of age) with epilepsy</td>
<td>29,000</td>
</tr>
<tr>
<td>Annual cost per patient for loss of productivity of a family member</td>
<td>449.37 €</td>
</tr>
<tr>
<td>Total for loss of productivity from caring for minors</td>
<td>13,031,730 €</td>
</tr>
</tbody>
</table>

Source: EY analysis based on Argumosa A y Herranz JL, “La repercusión económica de las enfermedades crónicas: El Coste de la epilepsia infantil en el año 2000”, Boletín de la Sociedad de Pediatría de Asturias, Cantabria y Castilla y León, 2001
5.2.4. Other costs paid by the patient

This category includes other charges directly paid by the patient, such as transport costs from visits to medical professionals and home care costs.

The costs for medicines paid by patients are not taken into account, due to the lack of registers and epidemiological studies to identify patient characteristics and break down the costs of drugs. This cost is included in the total for medicines covered under healthcare costs. However, it is worth mentioning that these medicines are subsidized and that the copayment system is regulated by the Resolution dated 15th December 2014 of the General Directorate of the Common Services Portfolio of the National Health and Pharmacy System (89).

Only the transport and home care costs of refractory patients are taken into consideration, since patients with controlled seizures generally do not incur these costs. From a study on refractory patients which indicates the annual cost paid by each patient, a total approximate cost of 284.07 euros is estimated (70). If we extrapolate the total refractory patients in Spain, the total cost for this concept rises to over 29 million euros.

<table>
<thead>
<tr>
<th>Table 11. Annual costs paid by the patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost paid per patient</td>
</tr>
<tr>
<td>Number of refractory patients</td>
</tr>
<tr>
<td>Total costs paid by patients</td>
</tr>
</tbody>
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From the different costs associated with epilepsy we can estimate the total, which amounts to over 2,763 million euros, broken down into healthcare costs, non-healthcare costs, costs from loss of labour productivity and costs paid by the patients. The sum of the healthcare costs and non-healthcare costs is approximately 64.2% of the total.

<table>
<thead>
<tr>
<th>Table 12. Total annual cost</th>
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<tbody>
<tr>
<td>Concept</td>
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<tr>
<td>Healthcare costs</td>
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<td>Non-healthcare costs</td>
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<tr>
<td>Costs for loss of labour productivity</td>
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<tr>
<td>Costs paid by the patients</td>
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<tr>
<td>Total costs</td>
</tr>
</tbody>
</table>

Source: EY Analysis
Key challenges and areas for improvement
6. Key challenges and areas for improvement

Epilepsy is a complex condition which requires a holistic patient approach and management to improve quality of life. The experts point out that there is still a long way to go to improve care in this disorder, despite the dedicated efforts of all agents involved to date.

A series of challenges and areas for improvement have been determined, with regards to both healthcare and overall care, placing the emphasis on the improvement of healthcare as well as the quality of life of patients with epilepsy. The following are included in these challenges and areas for improvement:

Healthcare

- **Reduction of mean waiting times for diagnostic tests:** despite the fact that in recent years increased efforts have been made for more diagnostic equipment and the latest technological advances to be made available, the majority of specialist centres and epilepsy units have limited access to certain tests, e.g. prolonged video-EEG monitoring, and this has significantly increased waiting times, up to over a year in some centres. Facilitating access to these tests would improve the differential diagnosis of epilepsy, and offer the patient treatment more in keeping with their needs, particularly refractory patients, thus improving their quality of life. Moreover, investment in technology and all that this entails leads to better health outcomes, promoting the sustainability of the national health system.

- **Standardisation of patient management:** there are currently significant differences in the management of epilepsy patients, depending on the centre or region where care is given. In this regard, it is worth underlining the importance of guidelines that standardise the management and care of epilepsy throughout Spain to ensure that all patients, regardless of their place of residence, receive specialised and comprehensive care.

- **Knowledge and specialisation in epilepsy:** it is essential to promote specialisation in epilepsy at all care levels: neurologists, paediatric neurologists, neurosurgeons, nurses, primary care physicians, and neuropsychologists, etc. It is essential that the different agents involved in the diagnosis, treatment and follow-up of epilepsy patients have excellent knowledge of the disease in order to ensure good health outcomes and quality of life. Furthermore, the experts point out that a great number of patients do not have access to a specialist epilepsy unit and are attended by centres where there are no epileptologists. This is mainly due to the limited number of centres with specialist medical units. It is therefore also essential to increase the number of medical epilepsy units and to improve those already in existence, creating a network and thus provide multidisciplinary and comprehensive care to a maximum number of regions. It is also important to enhance the medical-surgical units so that they can offer optimal surgical treatment.

- **Specialisation of nursing in epilepsy:** the nurse’s role in control and follow-up is fundamental, especially in the education of patients with different diseases. They have the most direct, continuous contact with patients, particularly in the specialist units. However, nurses play a very small role in neurology and paediatric neurology, particularly in the management of epilepsy. Therefore their presence needs to be increased and enhanced with specialist training in epilepsy, to improve the care of these patients.

- **Availability of treatments with better tolerability:** although there are now many antiepileptic drugs with favourable results in the control of seizures (70% of patients control their condition with drugs (3)) the adverse effects experienced by the majority of patients have a direct impact on quality of life and remain one of the major challenges of epilepsy.

- **Increased complementary healthcare offer (neuropsychologists, nutritionists, etc.):** in addition to the care received in health centres, hospitals and specialist centres, epilepsy patients require complementary care which, in turn, has a direct impact on their quality of life. However, this complementary care is highly limited or non-existent in many centres. The professionals underline the need to enhance the role of neuropsychologists, nutritionists, physiotherapists, rehabilitators and social services. These are key figures for providing the patient with physical and emotional support throughout their epilepsy.
Overall care

- **Better training of patients and carers in epilepsy:** the education and information provided to patients and their family members about the characteristics of the disorder, treatments and the importance of treatment adherence are crucial. They lead to good patient management and reduce the consequences and negative impact of the disorder, improving health outcomes and quality of life. The experts highlight the need for increased efforts in this regard and the importance of promoting the role of the nurse in dealing with patients in general and in providing education and information in particular.

- **Increased social awareness of epilepsy:** epilepsy and its symptoms and consequences are widely unknown by a large part of society. This disorder has always been linked to stigma, myths and beliefs, many of which have persisted to this day and have resulted in discrimination. For this reason, it is essential to carry out actions and initiatives which address the disorder’s main characteristics, symptoms and consequences and its impact on quality of life on both a social and a professional level.

- **Normalisation of the lives of patients with epilepsy:** one of the most complex challenges of this disorder lies in normalising the life of these patients. Many of them, even now, conceal their situation at work and socially and even from their family. One of the main reasons for this is the stigma society attaches to the disorder, due to a lack of knowledge and the fear of discrimination in personal and work situations. Raising the awareness of the general population and the main agents is crucial to integrate these patients into basic activities in society and enhance their quality of life.

- **Epilepsy data collection and analysis:** at present, as with most conditions, no official, true data exist on epilepsy or how these patients are managed by healthcare professionals. In this regard, the experts state that the creation of a national register is a key need and challenge. This type of register is essential for official epidemiological data collection, and to substantially improve the way the disease is approached by all agents involved.

- **Promotion of research projects in all areas of epilepsy:** despite the efforts made in research that have led to advances in pharmacology and technology in recent years, which has helped to improve patient care and quality of life, experts agree that further initiatives should be implemented, in the research of different fields of epilepsy: drug treatments, diagnostic systems, tools for the detection of seizures and patient monitoring, less invasive surgical systems, etc.
7 Initiatives for improving patient care and quality of life
7. Initiatives for improving patient care and quality of life

- Bearing in mind all the areas for improvement and challenges outlined in the previous section, together with the 8 pillars established in the 68th World Health Assembly (91), a set of actions have been identified which aim to improve quality of life, increase the efficiency of the healthcare system and reduce the costs associated with epilepsy.

### Actions targeted at healthcare professionals

- **Develop standardised guidelines for epilepsy patient care:** at present there is no standardised protocol. Therefore the experts agree on the need for valid, standardised patient care guidelines to be made available in all centres and hospitals where epilepsy is treated. Similarly, it would favor the accessibility of all therapeutic alternatives so that they were available throughout the national territory to facilitate clinical treatment in an equitable manner for all patients. The experts also highlight the importance of the availability of certain social and emotional information to answer patients’ queries during their medical visits. This information could cover questions regarding patient associations, potential social consequences of the disorder and how to manage them, and applying for occupational disability or a driving licence. The Spanish Society of Epilepsy (SEEP) or the Spanish Society of Neurology (SEN) are key agents in this regard.

- **Implement training for practitioners in the patient pathway:** due to the complexity of epilepsy, the experts agree that it is necessary to train the different healthcare professionals in different areas so that they have basic knowledge of this disorder. Training should be provided principally to primary care physicians, neurologists, nursing staff, paediatricians, neuropsychologists, nutritionists and psychiatrists.

- **Increase the role of nurses in epilepsy:** according to the experts, there are currently no specialist and specific nurses in the area of neurology or paediatric neurology and therefore they cannot offer the support required by the epilepsy specialists. Their role in this area should be enhanced so that they can provide specific services and play a key role in the management of this condition, especially in providing information and education to patients and family members.

- **Facilitate interaction between the different healthcare levels:** This study has explained the patient pathway and shows the different medical professionals involved in patient care. However, we detected several barriers to communication between the different care levels. Tools and procedures to aid communication need to be developed and provided, particularly between epileptologists, neurologists, paediatric neurologists, and primary care physicians to provide more comprehensive care.

- **Promote a clinical register of epilepsy:** no official clinical register exists in Spain and the experts agree that this is now one of the main shortcomings of the healthcare system, since there is no reliable national data available on this disorder. Due to the difficulty in creating an official register, the experts propose setting up a voluntary register made by the patients themselves, noting the details of their disorder and its progress with the help of software or an application. Also, although compiling and analysing data is an area for improvement in all areas of medicine, it should be given priority by the government with the cooperation of other key agents, scientific societies and healthcare professionals.
• **Increase specialist medical units and enhance medical-surgical units:** in previous chapters we have mentioned the main centres currently specialising in epilepsy in Spain and we have seen that not all patients have easy access to them. For this reason, new medical units specialising in epilepsy should be created and evenly distributed throughout Spain. Similarly, several of the existing medical epilepsy units are neither sufficiently large nor carry the necessary resources for the number of patients to be treated. Apart from creating new units, the experts also suggest that investment should be made to improve the existing units to maintain good quality care. This will ensure accessibility in receiving diagnosis, treatment and quality follow-up without having to travel long distances. The existing medical-surgical units need to be enhanced with the necessary systems and professionals to provide optimum surgical treatment to patients who need it. Furthermore, the introduction and reinforcement of complementary services to these specialist units is fundamental since they help to provide comprehensive care, thus improving health outcomes and quality of life.

• **Drive research into drugs and new technological systems to facilitate epilepsy management:** one of the main problems faced by epilepsy sufferers is that it can be impossible to detect epileptic seizures. Tools are currently being developed to detect epilepsy, they should continue to be promoted to make patients’ lives easier and help them cope with the condition. Pilot schemes should be started in some hospitals to gather information and test the efficacy of these tools to achieve optimal management of the condition.

• **Promote the creation of transitional consultations:** currently, there is no protocol on how to carry out the transition of adolescent patients to adulthood, between the ages of 14 and 18. In this period, patients go from being treated by the neuropaediatrician to adult neurology consultations. For this change to be as efficient as possible and the impact on the patient to be the minimum, protocols should be developed to help make the transition in an optimal way for both the specialist and patients and their families.

• **Promote research for the detection of drug-resistant epilepsy:** being able to detect if a patient is resistant to disease, especially in early epilepsies, is key both for the management of the pathology and for the prognosis of the patient, directly impacting on their quality of life. In this sense, clinical studies should be encouraged and promoted with the aim of early detection to improve patient care and quality of life.

### Actions targeting adult patients

• **Provide information on epilepsy to patients, family members and carers:** throughout the report we have mentioned the importance of informing and educating patients and the fact that specialists accentuate the need for joining forces in this area. Patient guidelines need to be created that are different to those already in existence, with the use of, for example, audiovisual means to facilitate visualisation and comprehension. The experts suggest these guidelines should be given to the patients just after diagnosis so as to ensure that they make use of them. These guidelines would help the patient to become more familiar with and understand their epilepsy and its consequences better, as well as the treatment and follow-up involved.

• **Develop applications for the control and follow-up of the disorder:** at present it is the patient who explains their situation to the doctor, their most recent seizures and their consequences and characteristics. This is of great significance because the specialists largely base their diagnosis, treatment and follow-up on this. In order to improve this aspect, the development of applications to record and monitor the follow-up of the epilepsy is key. This may be done by the patient or by a family member for children or people with learning difficulties. These applications in real time or at least once in the specialist’s surgery must be capable of uploading all the data stored on the shared system between the patient and their doctor, so that the latter can easily access this information, in order, and thus avoid transcription errors. It would also offer the patient useful information, providing answers to drug adherence and monitoring and other frequently asked questions.
> **Enabling refractory patients to qualify for disability:** as mentioned previously, epilepsy has a major impact on the quality of life of refractory patients. They may have problems in getting and keeping a job due to their repeated epileptic seizures and underlying problems. For this reason, efforts should be increased for refractory epilepsy patients to directly obtain recognition of their disability, if they so wish, in line with legal limitations. The clinical condition of these patients implies repeated visits to the doctor and their seizures are potentially incapacitating. The implementation of flexible working hours would also be helpful. The government and the patient associations play an essential role in driving these types of initiatives.

> **Promote the inclusion of epilepsy in Expert Patient programmes:** chronic illnesses, including epilepsy, entail a series of consequences which affect physical and emotional status. The Expert Patient programme promotes the role of the patient as the main person responsible for self-care and enables them to acquire the necessary skills for managing the symptoms of the disorder, achieve healthy life styles and a better quality of life. At present, there are several programmes of this type in some of the autonomous communities and they are achieving highly positive results, but only some include epilepsy. The inclusion of epilepsy in these programmes should be promoted on a global level to provide patients with the skills to manage their disorder.

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### Actions targeted at paediatric patients

> **Provide information and education on epilepsy to paediatric patients and their environment:** applications and games for tablet, mobile and computer can be developed to educate children about epilepsy, and show them how to manage their disorder and its symptoms from an early age. Information can thus be obtained interactively and entertainingly. In addition, soft toys and dolls can be created to enable smaller children to learn about epilepsy as they play.

> **Enhance actions for social and career guidance:** adolescence is a key time where decisions have to be taken that may significantly affect future careers. It is therefore necessary to provide social and career guidance for young people with epilepsy and provide them the information they need to make better decisions in keeping with their needs and expectations. Schools, further education institutions and patient associations are key agents for developing this type of action.

> **Promote actions aimed at teenagers through social networking:** social networks make it easy to directly contact young people and this has great impact on them. We suggest using these channels to approach epilepsy, with rigorous control of content, and enable young people with the disorder to share their experiences and knowledge with other patients. Major topics such as adherence to treatment or healthy life habits could be addressed, promoting the normalisation and social integration of these patients.
Actions targeted at society in general

- **Conduct awareness-raising campaigns on the disorder:** throughout the report we have highlighted the limited knowledge of epilepsy by society in general. A larger number of informative, impacting campaigns are needed endorsed by neurologists, paediatric neurologists and epileptologists who have experience in benchmark hospitals, with patients and with public administration that address different aspects of the disorder and its impact on patients. The collaboration of people of influence in society would provide greater visibility to the campaigns. The use of mass media is also essential to reach the highest number of people, as well as the organisation of events outside the hospital environment to guarantee a relaxed atmosphere and break with the hospital-centred routine of the patients. The main agents involved in epilepsy, together with public services, scientific and patient associations have an essential role to play in driving this type of initiative.

- **Invest in diagnostic tools and genetic tests:** the experts indicate that they currently have difficulties in accessing the main diagnostic tests such as video-EEG and other functional imaging tests. The same occurs with genetic tests which are key in the differential diagnosis of epilepsy. An investment in healthcare technology would promote optimum management by healthcare professionals and also have repercussions on the patients’ quality of life. Furthermore, good control of patients reduces the costs associated with the disorder, contributing to the sustainability of the healthcare systems.

- **Raise awareness and instruct teachers and school leaders:** there are still children today who have epilepsy and have difficulty in being accepted in some schools or institutions. The main reason for this is a lack of knowledge of the disorder and misinformation on what to do should an epileptic seizure occur. To address this problem, teachers, monitors and school leaders must be given tutorials and guidelines with information on the condition, to teach them how to behave in the event of a seizure. The objectives of these actions would be to normalise the schooling and everyday life of children with epilepsy, which would aid their academic and subsequent professional performance, contributing to a better quality of life.

- **Promote campaigns on epilepsy in educational and leisure centres:** the current problem of a general lack of knowledge about epilepsy affects young people. It may lead to bullying at school, which in turn may have other types of consequences on the child’s development and their academic progression. To resolve this, talks should be organised in all schools, but particularly where these children study, to provide education about epilepsy and help minimise the negative impact that the disorder has on them. Health education days could also be offered, as has been achieved in some regions, to disseminate information on different disorders, including epilepsy. This initiative is not only aimed at schools, but also at leisure centres, sports centres, extracurricular activity clubs where there are children and teenagers.

- **Promote the integration of patients with epilepsy into the workplace:** discrimination occurs not only in schools but also in the workplace, where it is known as mobbing. Awareness campaigns should also be conducted in companies and in other areas of employment so that the employees are made aware of the disorder to prevent discrimination in the workplace, and are shown how to act in the event of a seizure. Measures should be driven to widen employment opportunities for patients with epilepsy, helping them gain access to employment to suit their skills.

- **Strengthen employment protection formulas:** large number of parents with children or family members with disabilities who suffer from repeated seizures are forced to take leave of absence from their work to look after them and periodically accompany them to the doctor. The experts therefore highlight the need to introduce employment protection measures to safeguard these workers, so that they may dedicate some time to caring for the needs of their children or family members with epilepsy without feeling insecure about their employment.
8. Conclusions

1. Epilepsy is a neurological pathology which is characterised by suffering from epileptic seizures of diverse symptoms, caused by abnormal and uncontrolled neuronal activity

   The experts indicate that epilepsy is one of the main central nervous system disorders. It is also a chronic and complex condition which combines a broad variety of conditions of varying aetiology, prognosis and levels of severity. Its clinical, social and financial impact is high worldwide. Although the triggers for the condition are often unknown, epilepsy may be due to structural causes, such as trauma, or genetic or congenital metabolic diseases.

2. Its prevalence in Spain is sparsely reported although the experts believe that there are between approximately 320,000 and 365,000 people with epilepsy, of whom at least 29,000 are children

   Epilepsy is a pathology that can affect anyone, whatever their age, gender or race. The experts estimate that between 0.7% and 0.8% of the Spanish population suffer from some type of epilepsy and predict a 1% annual growth in prevalence in the elderly, due to the ageing population, which will amount up to 80,000 people over the age of 65 affected by the condition in 2066. However, the lack of national epidemiological studies on the current and future prevalence and incidence of epilepsy makes it difficult to quantify the actual volume of patients or the healthcare available for the disorder. The experts highlight the need for the creation of a national patient register to contribute towards substantially improving the distribution and provision of healthcare resources by public administrations and the management of the disorder in general.

3. The collaboration, presence and proximity of all the specialists and professionals involved in the management of the patient with epilepsy is pivotal to offering specialist, multidisciplinary, comprehensive healthcare

   Specialisation of professionals and coordination between the different healthcare agents is decisive in providing patients with complete healthcare. Although the neurologist or paediatric neurologist epileptologist is the key healthcare professional in management of the disorder, participation and support from healthcare professionals from other disciplines such as neurophysiology, neuropsychiatry, surgery, nursing and complementary services such as psychology and social work are also required. The coordination and presence of all of these specialists in the care pathway is of vital importance to offer comprehensive, quality care. It is noteworthy that epilepsy is currently the second cause of adult neurological emergencies, after strokes.

4. In Spain initiatives need to be generated for the creation of specialist medical units, for enhancing the existing medical-surgical units and for training healthcare professionals in epileptology

   In Spain, three out of every four patients attend neurology departments, where they are seen by a non-specialist neurologist or paediatric neurologist, due to the lack of medical units for epilepsy and the lack of epileptologists, particularly in paediatrics. Furthermore, in the existing medical units, access to the main diagnostic tests is limited and the waiting lists are long. In this context, one of the challenges of epilepsy is to promote initiatives aimed at training clinical experts in the disorder, and to drive actions to promote the creation of new medical units equipped with the right diagnostic systems, and actions to enhance state-of-the-art medical-surgical units. This would ensure that all patients had access to the diagnosis and treatment they need, regardless of geographical location.
Seventy percent of patients treated with antiepileptic drugs successfully control their seizures; the remaining 30% are refractory

Epilepsy is mostly treated with drugs. The objective is to successfully achieve complete remission of the seizures with the fewest adverse effects possible. However, many patients do not control their seizures with drugs and require other treatments. Five percent to 10% of patients with epilepsy are candidates for surgical treatment, although the success rate largely depends on the type of intervention and the clinical situation of the patient. Stimulation of the vagus nerve or a ketogenic diet are also treatments designed to reduce the frequency and severity of seizures and have a higher success rate in paediatric patients.

The costs associated with epilepsy in Spain amount to 2.76 thousand million euros each year, which is equivalent to almost 3% of public health spending

Epilepsy has a high financial impact as it includes healthcare costs from diagnosis, treatment and patient follow-up, as well as other costs associated with the disease. As a result, the specialisation and training of professionals in the main disciplines, and the creation of adequately equipped medical units for epilepsy are key to achieving a healthcare system more efficient in epilepsy management which would reduce public spending and improve the system’s sustainability.

Actions are needed to drive research in epilepsy in all areas and thus contribute to long-term improvement in healthcare quality

Despite the efforts made in recent years to improve healthcare for patients with epilepsy, the experts accentuate the need to promote and invest in researching all areas of the disorder and thus increase epidemiological studies, research into new drug regimes with higher tolerability, innovation into systems of diagnosis, monitoring and patient follow-up, and also the development of less invasive surgical techniques.

Even today, discrimination against epilepsy continues to greatly impact the patient socially and emotionally

Patients with epilepsy not only have to cope with the clinical conditions of the disorder throughout their lives, but are also subjected to its social and psychological consequences. The fear generated by lack of knowledge, stigma and low social awareness result in making these patients feel misunderstood, rejected or marginal to society and this affects their educational and professional performance. One of the major challenges of epilepsy is therefore to educate and raise the social awareness of patients, family members and society in general. Furthermore, the experts consider that it is crucial to drive initiatives to boost complementary services, including those of psychologists, to help patients cope with their condition and thus help them to improve the quality of their lives.
9. Acknowledgements

This report has had the collaboration of the following experts:

- Dr. Juan José García Peñas - Neuropaediatrician at Hospital Infantil Universitario Niño Jesús (Madrid)
- Dr. Manuel Toledo - Neurologist at Hospital Universitari de la Vall d’Hebron (Barcelona)
- Dr. José Serratosa - Head of the Neurology Service at Hospital Universitario Fundación Jiménez Díaz (Madrid)
- Sr. Juan Oliva - Specialist in Health Economics
- Sr. José Luís Domínguez - President of the Federación Española de Epilepsia

Although this report was drafted by the EY department of Life Sciences, we would like to emphasise the generous participation of several expert agents in the epilepsy sector who have contributed with their knowledge gained through broad experience. We would like to point out that this report does not include any citations or personal opinions of any of the collaborators; therefore they must not be identified by any citation within the submitted document.

The study also involved a large number of representatives of patient associations and patients who experience this disease first-hand. His continuous contributions have brought great value to the study and have been key to its development.

We are sincerely grateful to all of them for their support, valuable time and cooperation.

In collaboration with:  
In institutional collaboration with:
10. Glossary

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<td>CVA</td>
<td>Cerebrovascular accident (stroke)</td>
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<td>EAE</td>
<td>European Alliance Epilepsy</td>
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<td>EEG</td>
<td>Encephalography</td>
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<td>EURAP</td>
<td>International Register of Antiepileptic Drugs and Pregnancy</td>
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<td>AED</td>
<td>Antiepileptic drug</td>
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<td>FEEN</td>
<td>Spanish Federation of Neurological Diseases</td>
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<td>IBE</td>
<td>International Bureau for Epilepsy</td>
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<td>ILAE</td>
<td>International League Against Epilepsy</td>
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<td>INE</td>
<td>National statistics Institute</td>
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<td>LICE</td>
<td>Lega italiana contro l’epilessia (Italian league against epilepsy)</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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<td>PET</td>
<td>Positron Emission Tomography</td>
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<td>MR</td>
<td>Magnetic Resonance</td>
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<td>Spanish Society of Neurology</td>
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<td>SEEP</td>
<td>Spanish Society of Epilepsy</td>
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<td>SENEP</td>
<td>Spanish Society of Paediatric Neurology</td>
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<td>SCN</td>
<td>Societat de Neurologia Catalana (Catalan Society of neurology)</td>
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<tr>
<td>CNS</td>
<td>Central nervous system</td>
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<td>SPECT</td>
<td>Single positron emission computed tomography</td>
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<td>SUDEP</td>
<td>Sudden unexpected death in epilepsy patients</td>
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<td>CAT</td>
<td>Computed Axial Tomography</td>
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<td>CT</td>
<td>Computed Tomography</td>
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<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<td>HIV</td>
<td>Human Immunodeficient Virus</td>
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12. References

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