

## A Brief Overview of Epilepsy with Emphasis on Children

Ehsan Keykhosravi<sup>1</sup>, Masumeh Saeidi<sup>2</sup>, \*Mohammad Ali Kiani<sup>3</sup>

<sup>1</sup>Department of Neurosurgery, Akbar Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

<sup>2</sup>Department of Medical Education, Tehran University of Medical Sciences, Tehran, Iran.

<sup>3</sup>Department of Pediatrics, Mashhad University of Medical Sciences, Mashhad, Iran.

### Abstract

Epilepsy is a brain disorder in which a person has repeated seizures over time. A seizure is a sudden change in the electrical and chemical activity in the brain. A single seizure that does not happen again is NOT epilepsy. Most children with epilepsy live a normal life. Certain types of childhood epilepsy go away or improve with age, usually in the late teens or 20s. Nearly 80% of people with epilepsy live in low- and middle-income countries. The risk of premature death in people with epilepsy is up to three times higher than for the general population. There is no known way to prevent epilepsy. Proper diet and sleep may decrease the chances of seizures in children with epilepsy. Reduce the risk of head injury during risky activities. This can decrease the likelihood of a brain injury that leads to seizures and epilepsy. Treatment for epilepsy includes: Medicines, Lifestyle changes and Surgery. Three quarters of people with epilepsy living in low-income countries do not get the treatment they need.

**Key Words:** Adults, Children, Epilepsy, Prevention, Symptoms.

\*Please cite this article as: Keykhosravi E, Saeidi M, Kiani MA. A Brief Overview of Epilepsy with Emphasis on Children. Int J Pediatr 2019; 7(11): 10387-395. DOI: **10.22038/ijp.2019.44558.3688**

---

### \*Corresponding Author:

Mohammad Ali Kiani, Department of Pediatrics, Mashhad University of Medical Sciences, Mashhad, Iran.

Email: [kianima@mums.ac.ir](mailto:kianima@mums.ac.ir)

Received date: Mar.27, 2019; Accepted date: Oct 22, 2019

## INTRODUCTION

Epilepsy is a group of neurological disorders characterized by recurrent epileptic seizures (1, 2). Epileptic seizures are episodes that can vary from brief and nearly undetectable periods to long periods of vigorous shaking (3). These episodes can result in physical injuries, including occasionally broken bones (3). In epilepsy, seizures have a tendency to recur and, as a rule, have no immediate underlying cause (4). Isolated seizures that are provoked by a specific cause such as poisoning are not deemed to represent epilepsy (5). People with epilepsy may be treated differently in various areas of the world and experience varying degrees of social stigma due to their condition (3).

Epilepsy affects all age's groups. But for children, a variety of issues exist that can affect one's childhood. Some epilepsy ends after childhood. Some forms of epilepsy are associated only with conditions of childhood that cease once a child grows up (6). Approximately 70% of children who have epilepsy during their childhood eventually outgrow it (7). There are also some seizures, such as febrile seizures, that are one-time occurrences during childhood, and they do not result in permanent epilepsy (8). Pediatric epilepsy may cause changes in the development of the brain. For this reason, epilepsy in children is vastly distinct from epilepsy in adults and they must be considered differently in most regards.

As of 2015, about 39 million people have epilepsy (9). Nearly 80% of cases occur in the developing world (3). Epilepsy is more common in older people (10, 11). In the developed world, onset of new cases occurs most frequently in babies and the elderly (12). In the developing world, onset is more common in older children and young adults due to differences in the frequency of the underlying causes (13). About 5–10% of people will have an

unprovoked seizure by the age of 80 (14), and the chance of experiencing a second seizure is between 40 and 50% (15). One seizure does not signify epilepsy (up to 10% of people worldwide have one seizure during their lifetime). Epilepsy is defined as having two or more unprovoked seizures. Epilepsy is one of the world's oldest recognized conditions, with written records dating back to 4000 BC. Fear, misunderstanding, discrimination and social stigma have surrounded epilepsy for centuries. This stigma continues in many countries today and can impact on the quality of life for people with the disease and their families (3, 15, 16).

## SIGNS AND SYMPTOMS

Epilepsy is characterized by a long-term risk of recurrent seizures. Characteristics of seizures vary and depend on where in the brain the disturbance first starts, and how far it spreads. Temporary symptoms occur, such as loss of awareness or consciousness, and disturbances of movement, sensation (including vision, hearing and taste), mood, or other cognitive functions. People with epilepsy tend to have more physical problems (such as fractures and bruising from injuries related to seizures), as well as higher rates of psychological conditions, including anxiety and depression. Similarly, the risk of premature death in people with epilepsy is up to three times higher than in the general population, with the highest rates of premature mortality found in low- and middle-income countries and in rural areas. A great proportion of the causes of death related to epilepsy, especially in low- and middle-income countries are potentially preventable, such as falls, drowning, burns and prolonged seizures (3, 17-22).

## RATES OF DISEASE

Epilepsy accounts for a significant proportion of the world's disease burden,

affecting around 50 million people worldwide. The estimated proportion of the general population with active epilepsy (i.e. continuing seizures or with the need for treatment) at a given time is between 4 and 10 per 1000 people. Globally, an estimated five million people are diagnosed with epilepsy each year. In high-income countries, there are estimated to be 49 per 100 000 people diagnosed with epilepsy each year. In low- and middle-income countries, this figure can be as high as 139 per 100 000. This is likely due to the increased risk of endemic conditions such as malaria or neurocysticercosis; the higher incidence of road traffic injuries; birth-related injuries; and variations in medical infrastructure, the availability of preventive health programmes and accessible care. Close to 80% of people with epilepsy live in low- and middle-income countries (3).

## EPIDEMIOLOGY

Epilepsy is one of the most common serious neurological disorders (23) affecting about 39 million people as of 2015 (9). It affects 1% of the population by age 20 and 3% of the population by age 75 (11). It is more common in males than females with the overall difference being small (13, 24). Most of those with the disorder (80%) are in the developing world (3). The estimated prevalence of active epilepsy (as of 2012) is in the range 3–10 per 1,000, with active epilepsy defined as someone with epilepsy who has had a least one unprovoked seizure in the last five years (24, 25). Epilepsy begins each year in 40–70 per 100,000 in developed countries and 80–140 per 100,000 in developing countries (3). Poverty is a risk and includes both being from a poor country and being poor relative to others within one's country (13). In the developed world epilepsy most commonly starts either in the young or in the old (13). In the developing world its onset is more common in older children and young

adults due to the higher rates of trauma and infectious diseases (13). In developed countries the number of cases a year has decreased in children and increased among the elderly between the 1970s and 2003 (25). This has been attributed partly to better survival following strokes in the elderly (24).

## CAUSES

The cause of most cases of epilepsy is unknown. Epilepsy is not contagious. Although many underlying disease mechanisms can lead to epilepsy, the cause of the disease is still unknown in about 50% of cases globally. The causes of epilepsy are divided into the following categories: structural, genetic, infectious, metabolic, immune and unknown (3). Some cases occur as the result of brain injury, stroke, brain tumors, infections of the brain, or birth defects through a process known as epileptogenesis (3, 26, 27). Epilepsy can have both genetic and acquired causes, with interaction of these factors in many cases (28). Established acquired causes include serious brain trauma, stroke, tumours and problems in the brain as a result of a previous infection (28). In about 60% of cases the cause is unknown (3, 29). Epilepsies caused by genetic, congenital, or developmental conditions are more common among younger people, while brain tumors and strokes are more likely in older people (29). Seizures may also occur as a consequence of other health problems (29); if they occur right around a specific cause, such as a stroke, head injury, toxic ingestion or metabolic problem, they are known as acute symptomatic seizures and are in the broader classification of seizure-related disorders rather than epilepsy itself (3, 24, 30).

## DIAGNOSIS

The diagnosis of epilepsy is typically made based on observation of the seizure

onset and the underlying cause. An electroencephalogram (EEG) to look for abnormal patterns of brain waves and neuroimaging (CT scan or MRI) to look at the structure of the brain are also usually part of the workup. While figuring out a specific epileptic syndrome is often attempted, it is not always possible. Video and EEG monitoring may be useful in difficult cases (29).

## TREATMENT

Seizures can be controlled. Up to 70% of people living with epilepsy could become seizure free with appropriate use of antiseizure medicines. Low-cost treatment is available, with daily medication that costs as little as US\$ 5 per year. Discontinuing anti-seizure medicine can be considered after 2 years without seizures and should take into account relevant clinical, social and personal factors. A documented etiology of the seizure and an abnormal electroencephalography (EEG) pattern are the two most consistent predictors of seizure recurrence.

In low-income countries, about three quarters of people with epilepsy may not receive the treatment they need. This is called the “treatment gap”.

- In many low- and middle-income countries, there is low availability of antiseizure medication. A recent study found the average availability of generic antiseizure medicines in the public sector of low- and middle-income countries to be less than 50%. This may act as a barrier to accessing treatment.
- It is possible to diagnose and treat most people with epilepsy at the primary health-care level without the use of sophisticated equipment.
- WHO pilot projects have indicated that training primary health-care providers to diagnose and treat epilepsy

can effectively reduce the epilepsy treatment gap.

- Surgery might be beneficial to patients who respond poorly to drug treatments (3).

Epilepsy is often a lifelong or chronic illness. Important management issues include:

- Taking medicines
- Staying safe, such as never swimming alone, fall-proofing your home and so on
- Managing stress and sleep
- Avoiding alcohol and drug abuse
- Keeping up in school
- Managing other illnesses (19-21).

Most children who develop epilepsy are treated conventionally with anticonvulsants. In about 70% of cases of childhood epilepsy, medication can completely control seizures (7). Unfortunately, medications come with an extensive list of side effects that range from mild discomfort to major cognitive impairment. Usually, the adverse cognitive effects are ablated following dose reduction or cessation of the drug (31).

## PREVENTION

While many cases are not preventable, efforts to reduce head injuries, provide good care around the time of birth, and reduce environmental parasites such as the pork tapeworm may be effective. An estimated 25% of epilepsy cases are preventable.

- Preventing head injury is the most effective way to prevent post-traumatic epilepsy.
- Adequate perinatal care can reduce new cases of epilepsy caused by birth injury.

- The use of drugs and other methods to lower the body temperature of a feverish child can reduce the chance of febrile seizures.
- The prevention of epilepsy associated with stroke is focused on cardiovascular risk factor reduction, e.g. measures to prevent or control high blood pressure, diabetes and obesity, and the avoidance of tobacco and excessive alcohol use.
- Central nervous system infections are common causes of epilepsy in tropical areas, where many low- and middle-income countries are concentrated. Elimination of parasites in these environments and education on how to avoid infections can be effective ways to reduce epilepsy worldwide, for example those cases due to neurocysticercosis (3, 32-34).

There is no known way to prevent epilepsy. Proper diet and sleep may decrease the chances of seizures in children with epilepsy. Reduce the risk of head injury during risky activities. This can decrease the likelihood of a brain injury that leads to seizures and epilepsy (19-21).

### **SOCIAL AND ECONOMIC IMPACTS**

Epilepsy accounts for 0.5% of the global burden of disease, a time-based measure that combines years of life lost due to premature mortality and time lived in less than full health. Epilepsy has significant economic implications in terms of health-care needs, premature death and lost work productivity. The economic impact of epilepsy varies significantly depending on the duration and severity of the condition, response to treatment, and the health-care setting. Out-of-pocket costs and productivity losses create substantial burdens on households. An economic study from India estimated that public financing for both first- and second-line therapy and other medical costs alleviates

the financial burden from epilepsy and is cost-effective. Although the social effects vary from country to country, the stigma and discrimination that surround epilepsy worldwide are often more difficult to overcome than the seizures themselves. People living with epilepsy can be targets of prejudice. The stigma of the disease can discourage people from seeking treatment for symptoms, so as to avoid becoming identified with the disease (3, 35, 36). The social stigma can stand in the way, as the child is more prone to bullying (37). Many children with epilepsy are overprotected by their parents, who do put restrictions on them in the name of safety, requiring more adult supervision than other children, and not allowing them to participate in certain activities normal to the age group, such as sports.

### **EDUCATION**

Epilepsy can affect a child's education, thereby leading to trouble learning and lower grades. While many children are capable of functioning in a normal classroom environment, many end up in special education (38). The child may be forced to miss a lot of school due to seizures. The seizures can impair a child's ability to memorize learning materials. Tonic-clonic seizures can have a serious impact on education due to the memory loss they cause, and the time needed to recover following the seizure-causing there to be missed time in school (39). Absence seizures can have a high negative impact on a child's education. As they are less obvious than tonic-clonic seizures, they can occur many times within a single day, thereby resulting in the child's ability to learn being impaired, and leading to low grades (40). Often, these educational deficits lead to the investigation of neurological conditions and result in the diagnosis of this seizure subtype. Children may appear to be 'zoning out' or day-dreaming during classes when in actuality they are experiencing uncontrolled absent

seizures. Once treatment begins, these children often exhibit improved attention and their grades improve. When seizures are controlled by medication, many anticonvulsants have side effects that include drowsiness, thereby also impacting a child's education (40).

## LANGUAGE

In cases of chronic pediatric epilepsy there is often an association with reduced language skills. The classically understood language areas of the brain are Broca's area and Wernicke's area. Realistically, language is significantly more complex and involves several cortical areas beyond these regions (41). Language deficits may present with a wide variety of symptoms ranging from odd patterns of speech to complete aphasia of speech. Unfortunately there is not a significant amount of data that parses out how an epileptic firing patterns will cause a resulting language deficit. The correlation of epileptic activity and language deficit is undeniably present, but the mechanisms involved have yet to be unraveled. In the developing brain, epilepsy may cause the language areas to be structurally altered leading to developmental difficulties. In turn, a child may have trouble acquiring communication skills at a normal rate (42). This delay may in some children be resolved by compensatory mechanisms or alleviated by medication and therapy, but in some children with persistent epilepsy, the delay may remain or worsen as they age. In the case of temporal lobe epilepsy (TLE), studies have shown that there is structural compromise to the fiber tracts associated with memory and language, providing some explanation for the impairments in patients with epilepsy (43). In some cases, language impairment may be the first indicator of epileptiform activity in the brain of children. A study done at the University of Gothenburg showed that language impairments were

more common in children with epileptic brain activity than children without (42).

## HUMAN RIGHTS

People with epilepsy can experience reduced access to educational opportunities, a withholding of the opportunity to obtain a driving license, barriers to enter particular occupations, and reduced access to health and life insurance. In many countries legislation reflects centuries of misunderstanding about epilepsy. For example:

- In both China and India, epilepsy is commonly viewed as a reason for prohibiting or annulling marriages.
- In the United Kingdom of Great Britain and Northern Ireland, laws which permitted the annulment of a marriage on the grounds of epilepsy were not amended until 1971.
- In the United States of America, until the 1970s, it was legal to deny people with seizures access to restaurants, theatres, recreational centres and other public buildings.

Legislation based on internationally-accepted human rights standards can prevent discrimination and rights violations, improve access to health-care services, and raise the quality of life for people with epilepsy (3).

## CONCLUSION

- Epilepsy is a chronic non-communicable disease of the brain that affects people of all ages.
- Around 50 million people worldwide have epilepsy, making it one of the most common neurological diseases globally.
- Nearly 80% of people with epilepsy live in low- and middle-income countries.

- It is estimated that up to 70% of people living with epilepsy could live seizure-free if properly diagnosed and treated.
- Some epilepsy ends after childhood. Some forms of epilepsy are associated only with conditions of childhood that cease once a child grows up.
- Approximately 70% of children who have epilepsy during their childhood eventually outgrow it. There are also some seizures, such as febrile seizures, that are one-time occurrences during childhood, and they do not result in permanent epilepsy.
- Pediatric epilepsy may cause changes in the development of the brain. For this reason, epilepsy in children is vastly distinct from epilepsy in adults and they must be considered differently in most regards.
- The risk of premature death in people with epilepsy is up to three times higher than for the general population.
- Three quarters of people with epilepsy living in low-income countries do not get the treatment they need.
- In many parts of the world, people with epilepsy and their families suffer from stigma and discrimination.
- Epilepsy cannot usually be cured, but medication can control seizures effectively in about 70% of cases.
- Of those with generalized seizures, more than 80% can be well controlled with medications while this is true in only 50% of people with focal seizures.
- In the developing world, 75% of people are either untreated or not appropriately treated. This is partly related to appropriate medications not being available or being too expensive.
- People with epilepsy are at an increased risk of death. This increase is

between 1.6 and 4.1 fold greater than that of the general population.

- The greatest increase in mortality from epilepsy is among the elderly (3, 6-8, 32-34, 44, 45).

**CONFLICT OF INTEREST:** None.

## REFERENCES

1. Chang BS, Lowenstein DH. "Epilepsy". *The New England Journal of Medicine*. 2003; 349 (13): 1257–66. doi:10.1056/NEJMra022308.
2. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. "ILAE official report: a practical clinical definition of epilepsy" . *Epilepsia*. 2014; 55 (4): 475–82.
3. Epilepsy Fact sheet. WHO. February 2016. Archived from the original on 11 March 2016. Retrieved 4 March 2016.
4. Chang BS, Lowenstein DH. "Epilepsy". *The New England Journal of Medicine*. 2003; 349(13):1257–66.
5. Fisher R, van Emde Boas W, Blume W, Elger C, Genton P, Lee P, et al. "Epileptic seizures and epilepsy: definitions proposed by the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE)". *Epilepsia*. 2005; 46 (4): 470–2. PMID 15816939.
6. *Epilepsy: A Guide to Balancing Your Life* By Ilo E. Leppik: p. 35.
7. *Epilepsy: Patient and Family Guide* By Orrin Devinsky: p.6.
8. *Epilepsy: A Guide to Balancing Your Life* By Ilo E. Leppik: p. 36.
9. Vos, Theo, Allen, Christine, Arora, Megha, Barber, Ryan M, Bhutta, Zulfiqar A, Brown, Alexandria, et al. "Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015". *Lancet*. 2016; 388 (10053): 1545–1602.
10. Brodie MJ, Elder AT, Kwan P (November 2009). "Epilepsy in later life". *The Lancet Neurology*. 8 (11): 1019–30. doi:10.1016/S1474-4422(09)70240-6.

11. Holmes TR, Browne GL. Handbook of epilepsy (4th ed.). Philadelphia: Lippincott Williams & Wilkins. 2008; p. 7. ISBN 978-0-7817-7397-3.
12. Wyllie's treatment of epilepsy: principles and practice (5th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins. 2010. ISBN 978-1-58255-937-7. Archived from the original on 24 June 2016.
13. Newton CR, Garcia HH. "Epilepsy in poor regions of the world". *Lancet*. 2012; 380 (9848): 1193–201. doi:10.1016/S0140-6736(12)61381-6. PMID 23021288.
14. Wilden JA, Cohen-Gadol AA. "Evaluation of first nonfebrile seizures". *American Family Physician*. 2012; 86 (4): 334–40.
15. Berg AT. "Risk of recurrence after a first unprovoked seizure". *Epilepsia*. 2008; 49 Suppl 1: 13–8.
16. Magiorkinis E, Sidiropoulou K, Diamantis A. "Hallmarks in the history of epilepsy: epilepsy in antiquity". *Epilepsy & Behavior*. 2010; 17(1): 103. PMID 19963440
17. Duncan JS, Sander JW, Sisodiya SM, Walker MC. "Adult epilepsy" (PDF). *Lancet*. 2006; 367 (9516): 1087–1100.
18. National Clinical Guideline Centre. The Epilepsies: The diagnosis and management of the epilepsies in adults and children in primary and secondary care. National Institute for Health and Clinical Excellence. 2012; pp. 21–28. Archived from the original on 16 December 2013.
19. Ghatan S, McGoldrick PE, Kokoszka MA, Wolf SM. Pediatric epilepsy surgery. In: Winn HR, ed. *Youmans and Winn Neurological Surgery*. 7th ed. Philadelphia, PA: Elsevier; 2017: chap 240.
20. Mikati MA, Hani AJ. Seizures in childhood. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, eds. *Nelson Textbook of Pediatrics*. 20th ed. Philadelphia, PA: Elsevier; 2016: chap 593.
21. Pearl PL. Overview of seizures and epilepsy in children. In: Swaiman K, Ashwal S, Ferriero DM, et al, eds. *Swaiman's Pediatric Neurology: Principles and Practice*. 6th ed. Philadelphia, PA: Elsevier; 2017: chap 61.
22. Epilepsy in children. Available at: <https://medlineplus.gov/ency/article/007681.htm>.
23. Hirtz D, Thurman DJ, Gwinn-Hardy K, Mohamed M, Chaudhuri AR, Zalutsky R. "How common are the "common" neurologic disorders?". *Neurology*. 2007; 68 (5): 326–37. PMID 17261678.
24. Neligan A, Hauser WA, Sander JW. "The epidemiology of the epilepsies". *Epilepsy. Handbook of Clinical Neurology*. 2012; 107: pp.113–33. doi:10.1016/B978-0-444-52898-8.00006-9. ISBN 978-0-444-52898-8.
25. Sander JW. "The epidemiology of epilepsy revisited". *Current Opinion in Neurology*. 2003; 16 (2): 165–70.
26. Hammer GD, McPhee SJ, eds. "7". *Pathophysiology of disease: an introduction to clinical medicine* (6th eds.). New York: McGraw-Hill Medical; 2010. ISBN 978-0-07-162167-0.
27. Goldberg EM, Coulter DA. "Mechanisms of epileptogenesis: a convergence on neural circuit dysfunction". *Nature Reviews. Neuroscience*. 2013; 14 (5): 337–49. doi:10.1038/nrn3482. PMC 3982383.
28. Berkovic SF, Mulley JC, Scheffer IE, Petrou S. "Human epilepsies: interaction of genetic and acquired factors". *Trends in Neurosciences*. 2006; 29 (7): 391–7.
29. National Clinical Guideline Centre. The Epilepsies: The diagnosis and management of the epilepsies in adults and children in primary and secondary care, 2012.
30. Thurman DJ, Beghi E, Begley CE, Berg AT, Buchhalter JR, Ding D, et al. ILAE Commission on Epidemiology. "Standards for epidemiologic studies and surveillance of epilepsy". *Epilepsia*. 2011; 52 Suppl 7: 2–26.
31. Greener, Mark. "Beyond seizures: understanding cognitive deficits in epilepsy". *Progress in Neurology and Psychiatry*; 2013; 31–32 – via Wiley.
32. Bergey GK. "Neurostimulation in the treatment of epilepsy". *Experimental Neurology*. 2013; 244: 87–95.
33. Martin K, Jackson CF, Levy RG, Cooper PN. "Ketogenic diet and other dietary



- treatments for epilepsy". The Cochrane Database of Systematic Reviews. 2016; 2: CD001903.
34. Eadie MJ "Shortcomings in the current treatment of epilepsy". *Expert Review of Neurotherapeutics*. 2012; 12(12): 1419–27. doi:10.1586/ern.12.129. PMID 23237349.
35. Wilden JA, Cohen-Gadol AA. "Evaluation of first nonfebrile seizures". *American Family Physician*. 2012; 86(4): 334–40.
36. Martindale JL, Goldstein JN, Pallin DJ. "Emergency department seizure epidemiology". *Emergency Medicine Clinics of North America*. 2011; 29(1): 15–27.
37. *Epilepsy: The Ultimate Teen Guide* By Kathlyn Gay, Sean McGarrahan: page 42.
38. *Epilepsy: Patient and Family Guide* By Orrin Devinsky: page 247-48.
39. *Epilepsy: A Guide to Balancing Your Life* By Ilo E. Leppik: page 32.
40. *Epilepsy: A Guide to Balancing Your Life* By Ilo E. Leppik: page 31.
41. Chou, Naomi; Serafini, Sandra; Muh, Carrie R. "Cortical Language Areas and Plasticity in Pediatric Patients with Epilepsy: A Review". *Pediatric Neurology*. 2018;78:3-12.
42. Language dysfunction in children may be due to epileptic brain activity". *Science Daily*. Retrieved 2017-12-07.
43. McDonald, C. R.; Ahmadi, M. E.; Hagler, D. J.; Tecoma, E. S.; Iragui, V. J.; Gharapetian, L.; Dale, A. M.; Halgren, E. (2008-12-02). "Diffusion tensor imaging correlates of memory and language impairments in temporal lobe epilepsy". *Neurology*. 2008; 71 (23): 1869–76. ISSN 0028-3878.
44. Hitiris N, Mohanraj R, Norrie J, Brodie MJ. "Mortality in epilepsy". *Epilepsy & Behavior*. 2007;10 (3): 363–76. doi:10.1016/j.yebeh.2007.01.005.
45. Shorvon S, Perucca E, Engel J, eds. *The treatment of epilepsy* (3rd ed.). Chichester, UK: Wiley-Blackwell. 2009; p. 28. ISBN 978-1-4443-1667-4.