How to Cite:

Al-Aameri, K. K. J., & AL-Mayahi, N. Y. S. (2022). Correlation between epilepsy risk factors and type of seizures in children. *International Journal of Health Sciences*, 6(S3), 5980–5989. https://doi.org/10.53730/ijhs.v6nS3.7314

Correlation between epilepsy risk factors and type of seizures in children

Karrar Kadhim Jawad Al-Aameri

PhD. Students, Faculty of Nursing, University of Babylon, Iraq *Corresponding author email: Krarnurse424@gmail.com

Naji Yasser Saadoon AL-Mayahi

Assist. Prof. Dr., Faculty of Nursing, University of Babylon, Iraq

Abstract --- Epilepsy is uncommon on its own, and comorbidities are common: more than half of patients with epilepsy have one or more other medical disorders. Epilepsy has long been linked to psychiatric disorders (such as Extreme stress, extreme sadness, hyperactivity, and attention deficit), but more recently, epilepsy has been linked to somatic disorders (such as Disorders of the pancreas and its secretion of insulin, problems with tendons and joints, diseases that affect the stomach and chronic diseases related to the lung). A descriptive, Case-Control study was conducted. The research was carried out across Iraq's five Middle Euphrates Governorates, between the 1st of October 2021 and the 1st of May 2022. For the purpose of determining risk factors for epilepsy in children and to identify the relationship between the risk factors and parents socio-demographic data, clinical data and daily habits. The data was collected through the use of the questionnaire and data analysis by SPSS version 22. The findings indicate that the most important factors influencing the occurrence of epilepsy in children are as follows: (asphyxia, trauma during delivery, jaundice, febrile, encephalitis, meningitis, brain tumor, ADHD, and head trauma). as well as the occurrence of epilepsy is influenced by considerable sleep disruption. In addition, children with epilepsy who were five years old or younger had the highest percentage of initial seizures. This study concluded that the study showed that there is a relationship between the factors that lead to the occurrence of epilepsy and the type of epilepsy, where there was a relationship between suffocation and the type of generalized epilepsy, while the other factor was trauma during labor, which was common in generalized and partial epilepsy.

Keywords---correlation, epilepsy, risk factors, seizures.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

Manuscript submitted: 9 March 2022, Manuscript revised: 18 April 2022, Accepted for publication: 1 May 2022 5980

Introduction

5981

Epilepsy is uncommon on its own, and comorbidities are common: more than half of patients with epilepsy have one or more other medical disorders. Epilepsy has long been linked to psychiatric disorders (such as Extreme stress, extreme sadness, hyperactivity, and attention deficit), but more recently, epilepsy has been linked to somatic disorders (such as Disorders of the pancreas and its secretion of insulin, problems with tendons and joints, diseases that affect the stomach and chronic diseases related to the lung) (Yuen, Keezer and Sander, 2018). A variety of possible associative mechanisms have been discovered. People who have several illnesses are more likely to be sent to other experts, resulting in a collection bias since persons who have a comorbid ailment remain recognized earlier than those who do not. The connections, on the other hand, do not fully explain the mechanisms. The most evident mechanism of linkage is a causal relationship (for example, a stroke producing epilepsy). Epilepsy and its treatment can cause a variety of problems (eg, effects ant seizure medications or the significances of seizure such as fracture). Shared risk factor is an original ingredient or circumstance that causes two or more conditions to arise. Environmental, genetic, neurochemical, physiological, or anatomical risk factors can all play a role.

(Keezer, Sisodiya and Sander, 2016).Risk factors differ depending on the age group. Epilepsy that starts before adulthood is more likely to have brain development abnormalities. Epilepsy caused by head trauma, infections, or tumors can strike at any age. In elderly persons, the most prevalent risk factor is cerebrovascular illness. Because parasitic diseases Such as diseases related to immune disorders are among the most common avoidable risky for epileptic disorder around the world, geographic location is crucial. (Tan, 2014).Epilepsy affects about 80 person of people living in low- and middle-income nations. Epilepsy is stigmatized in many regions of the world, and patients may be denied treatment. Above seventy five percent of people with epilepsy go untreated, resulting in a significant treatment hole, which is primarily concentrated in low and middle, income nations. (Hu et al., 2021). High income people, the occurrence of epilepsy is similar across areas, with an annual incidence of roughly fifty (about forty to seventy) for 100 000 individuals. It has a bimodal distribution, with two peaks: in newborns under one year of age and in persons over 50 years of age. Epilepsy is more common in low income people than in the high income ones, with rates typically exceeding eighty tone hundred for hundred thousand individuals every year; though, poor care of health system, reduced cleanness, and a lack the basic amenities contribute to this.(Wang et al., 2019; Zhu et al., 2021).

Epilepsy is a disorder brain disease that distresses persons of all ages world-wide (Nimesh *et al.*, 2019) .Epilepsy is a syndrome characterized by spontaneous, recurring seizures, with at least two seizures or more required to be diagnosed as epileptic. It is a common neurological disorder that affects an estimated 50 million individuals worldwide and is defined by abnormal activity of electrical in the brain that causes changes in body movement or affects awareness, perception, or performance. The underlying etiology of epilepsy is unclear in around 80% of cases. Trauma of Head and stroke are most common causes for epilepsy.

According to estimates, 50-70 million individuals worldwide suffer with epilepsy, 4.6 million instances are reported each year., epilepsy entails significant hazards of disability, loneliness, economic loss, and early mortality.(Jebur, Jumaa and Hussain, 2021).Active epilepsy affects four to twelve people out of every 1000 people, depending on where they live. (Zentner, 2012; Fiest et al., 2016; Socała et al., 2021).The classifiers are elective and are reliant on on the level of point given. Motorized and non- Motorized petit mal seizure are two types the generalized seizures. Unclassifiable seizures may have distinguishing characteristics. Somebody giving with fits without medical signs of focused or generalized onset is common occurrence. These seizures are defined as tonic-clonic seizures with an unclear onset.(Tan, 2014; Mishra et al., 2017).

Epileptogenic networks are widely dispersed in generalised epilepsies, involving bilateral thalamocortical regions. (Fisher and Bonner, 2018; Powell et al., 2018; Iacone et al., 2021). The majority of generalized epilepsies are assumed to be hereditary. (Afawi et al., 2016) Focal epilepsies, on the other hand, were thought to be chiefly categorized by structural brain abnormalities, particularly in resistant of drug in epilepsy.(Ryvlin, Cross and Rheims, 2014; Valentín et al., 2015; Nomura et al., 2016). Generalised epilepsies, particularly idiopathic generalised epilepsies and developmental epileptic encephalopathies, were thought to be caused mostly by genetic defects in the past. Focal epilepsies, on the other hand, can have a hereditary component.(Goldberg and Coulter, 2013; Guo et al., 2013; Perucca, Crompton, et al., 2017; Perucca, Scheffer, et al., 2017). The pathophysiological mechanisms that cause seizure activity as a result of structural flaws are unknown. Seizures are primarily triggered by activity of abnormal in neurons of cortical, but glial cell and axon in the white matter may also be complicated. An epileptform brain insult, proconvulsant drugs, stimulation of electrical, or traumatic of brain injury in animals provide a wealth of information.(Weckhuysen et al., 2016; Perucca, Scheffer, et al., 2017).(Löscher, 2011; Barker-Haliski, Sills and White, 2014)

Methods

A descriptive Case-Control study design was used. Between the 1st of October 2020 and the 1st of May 2022.A study was accompanied in five "Middle Euphrates" Governorates (Njaf Al-Ashraf, Karbala, Babylon, Al-Oādisivvah and Al-Muthana Governorates) (The Middle Euphrates Neurosciences Center, Imam Hussain Medical City, Imam Sadiq General Hospital and Al-Hilla General Teaching Hospital, Al-Diwaniyah Teaching Hospital/Neuroscience Center, and Al-Hussein Teaching Hospital) .Validity refers to a questionnaire's capacity to collect required data. For the purpose of determining the validity of the created questionnaire, 20 experts (with more than They have at least five years of experience) In order to examine the questionnaire for the current study, relevance, intelligibility, and clarity in achieving the chosen objectives. Furthermore, the majority of specialists agreed that the questionnaire was welldesigned and constructed for determining epilepsy risk factors. Furthermore, the expert recommendations were occupied into account. The final reproduction of the research instrument has been revised and ready for use in this study so far. The collection of data period continued from 10th March 2021 to 13th November 2021. The collection plan was for five governorates of Iraq, which represent the middle Euphrates region, which is equivalent to a third of the area of Iraq, as the researcher scheduled sampling as follows , the beginning was from Najaf Governorate, the Middle Euphrates Center for Neurosciences And for a period of two weeks from the first month after obtaining approval from the Training and Human Development Center of the Najaf Health Department, on the date 9/3/2021, After that, according to the plan developed by the researcher, the third week was the share of Al-Diwaniyah Governorate, Al-Diwaniyah Teaching Hospital, Neurosynthetics Center, after obtaining approval from the Training and Staff Development Department, Diwaniyah Governorate, Diwaniyah Health Department After the fourth week, went to the Imam Al-Sadiq Teaching Hospital and Al-Hilla Teaching Hospital, which are affiliated to the province of Babylon, after obtaining the initial approval to collect the sample from the Babylon Health Department, Among the hospitals mentioned above. The data was collected through the use of the questionnaire and data analysis by SPSS version 22.

Results

Table 1 Statistical distribution of the studied groups according to Child related-Demographic data

Child related-Demographic data		Epilepsy	y Cases	Control	
		Freq.	%	Freq.	%
Age of the child	<= 2	47	13.99	88	26.19
	3 - 5	85	25.30	68	20.24
	6 - 8	117	34.82	103	30.65
	9 - 11	46	13.69	41	12.20
	12 and more	41	12.20	36	10.71
Gender	male	192	57.14	106	31.55
	female	144	42.86	230	68.45
living location	rural	144	42.86	99	29.46
	urban	192	57.14	237	70.54
Educational level	illiterate	188	55.95	181	53.87
	continuous in elementary school	111	33.04	148	44.05
	interrupted elementary school	37	11.01	7	2.08
Child's hobbies	computer and mobile games	106	31.55	82	24.40
	TV	12	3.57	11	3.27
	play football	15	4.46	14	4.17
	no hobbies	203	60.42	229	68.15
Total		336	100%	336	100%

	classification of epilepsy							
Studied Piels feators	Chi-square			Post-hoc analysis				
Studied Risk lactors	X^2	d f	Sig.	gener al	part ial	syndr ome	unclas sified	
during delivery problem (asphyxia)	19.628	3	.001	0.001	NS	NS	NS	
during delivery problem (trauma during delivery)	10.157	3	. <mark>038</mark>	0.02	0.0 3	NS	NS	
post-delivery problem (0- 1)(jaundice)	56.140	3	<.001	<0.00 1	NS	NS	NS	
post delivery problem (1- 12)(febrile)	63.354	3	<.001	<0.00 1	NS	NS	NS	
encephalitis	6.040	3	.196	NS	NS	NS	NS	
meningitis	10.653	3	.031	0.024	NS	0.022	NS	
brain tumor	10.983	3	.027	0.024	NS	NS	0.012	
ADHD	7.140	3	.129	NS	NS	NS	NS	
head trauma	24.287	3	<.001	<0.00 1	NS	NS	NS	
sleep well	5.532	3	.159	NS	NS	NS	NS	
consongsity	1.838	3	.120*	NS	NS	NS	NS	
history of epilepsy	54.103	3	<.001	<0.00 1	NS	<0.00 1	NS	
smoker	1.229	3	.747	NS	NS	NS	NS	
history of epilepsy	14.920	3	.005	0.004	NS	NS	NS	

Table 2Relationship between classification of epilepsy and Studied Risk factors by using
Chi-square and *Post-hoc* analysis

Table 2: The study showed that there is a relationship between the factors that lead to the occurrence of epilepsy and the type of epilepsy, where there was relationship between suffocation and the type of generalized epilepsy by Post -hoc statistical analysis, with a significant level of 0.0001, while the other factor was trauma during labor, which was at a significant level of 0.038, which was common in generalized and partial epilepsy. The study also showed a relationship with a significant level of >0.001 for the factor of jaundice, which was common in generalized epilepsy, as well as in the case of high temperature, While the meningitis factor was a significant level of 0.031, which was common in generalized epilepsy and syndromes. The study showed a important relationship of brain tumors with a significant level of 0.027, which was prevalent in generalized and unclassified epilepsy. While the postpartum head trauma were significantly related to> 0.001, which was prevalent in generalized epilepsy, The study also showed the relationship of the pathological history of the father and the mother with a significant level of> 0.001 and 0.005, which was more common in generalized epilepsy.shows that there are a significant relationship between studied risk factors and most type of epilepsy.

Discussion

The present study involved study group of 336 and control group 336 Iraqi children with epileptic with mean of preschool and school age in both groups, and most common of them were aged ranging from 6-8 in both study and control groups (34.82% and 30.65%) years. This finding is unreliable with the Brazilian research prepared in 2010 by Letícia et al., which found that mean age of children included the study was 53.0% were 0-5 years of age, 32.6% were 6- 10 years of age.(Sampaio et al., 2010). The reason for the increase in visits to health institutions for the age group between six to eight years is likely due to the new changes in the life of the affected child, such as their entry to school, which may lead to increased pressure on children or their exposure to violence, as it increases the frequency of the attack for the affected child.Regarding the gender of participants, males were the dominant gender among child with epilepsy, The males had the highest percentage in the study group (57.14%), while females were higher in the control group (68.45%). For example, X-linked ARX mutations have been implicated in a form of infantile spasms affecting boys only. On the other hand, girls are more commonly diagnosed with childhood absence epilepsy. There is some evidence that the incidence of seizures and epilepsy has tended to decrease over time. This may be the result of more precise diagnosis due to the major advances in diagnostic and treatment methods, improvement in prenatal care, and decreases in children's exposure to factors that increase the risk of seizure.(Berg, Jallon and Preux, 2013).Concerning residence, the highest percentage were urban in both groups study and control (57.14% and 70.54%) respectively.

Where the two researchers (Peter Camfield, Carol Camfield Dalhousie) did not agree with this studye in 2015 about the prevalence rate seems highest in rural areas.(Camfield P and Camfield C., 2015).The number of residents in the city is more than the number in the countryside, so the number of visitors to health institutions, which are inside the cities, will be more. It is expected that people in the rural depend on health centers that are near their homes, especially during the period when the Corona virus is spreading, which leads to confusion and change in the work of some institutions, some of which are completely transformed into the care of Corona patients. With respect to the level of education of included children The study showed that the educational level of the affected children was in varying proportions, as follows: the illiterate, one hundred and eighty-eight cases, and the uninfected one hundred and eighty-one. As for those who are continuing in the study, one hundred and eleven cases of infected and uninfected are one hundred and forty-eight.As for the infected children who refuse the study, there are thirty-seven cases, and the uninfected children are only seven. That children with epilepsy are mostly with illiterate education level.Learning problems are one of the things that affect academic performance ,Difficulty learning leads to activity and skill disturbances for children in their daily lives ,Which in turn affects the educational performance at the arithmetic, reading and writing levels, which are at a normal level for healthy people, However, the difficulty in learning is still unclear and vague. The general rate of learning disorders was between two to ten percent, and the most common problem was related to reading.

One of the most common problems affecting youngsters is epilepsy., So it can lead to a disturbance in the development stage and thus weaken the level of cognition (Pavlou and Gkampeta, 2011). We must bear in mind that improving the teaching performance of children and developing the environmental, family, social and psychological effects will greatly help in improving the imbalance resulting from epilepsy in children. And that does not affect the fact that epilepsy is one of the problems that lead to learning problems, and this is what many studies have found. So we must continue to strengthen the conditions surrounding the child in order to be in a better condition. This could be due to the fact that both current and Thai studies have been conducted in underdeveloped world countries where people's levels of education range from middle to low. (Glozman, 2013).With regard to the factors that were identified in the study and their relationship to the type of epilepsy that affects children, the results were: Asphyxia is one of the factors that are common in generalized epilepsy, while the factor of head blows during childbirth was associated with generalized and partial epilepsy. The study shows that jaundice and fever are the most common in generalized epilepsy.While the previously identified factor, meningitis, was prevalent in generalized epilepsy and syndromes.

Generalized and unclassified epilepsy for brain tumor was the most common, While the postpartum head trauma which was prevalent in generalized epilepsy, The study also showed the relationship of the pathological history of the father and the mother, which was more common in generalized epilepsy.Where the researcher Chowdhury found in the year 2014 that the factor that was studied and identified is high temperature, which was similar to what we have as it was more common in generalized epilepsy. (Chowdhury, 2014). The same is the case with regard to those with a family history. It was common in generalized epilepsy, according to researcher Abdulkareem in 2022. (Abdulkareem, 2022). While the researcher Sampaio et al., did not agree with us regarding suffocation during childbirth, who found in 2010 that the majority of patients with epilepsy due to the suffocation factor are from the majority who develop partial epilepsy.(Sampaio et al., 2010). In 2018 by researchers Kumar and Kalita, found that meningitis can be partial or sometimes associated with generalized epilepsy or secondary generalized epilepsy. (Kumar and Kalita, 2018). The researcher also likened us, where he found that generalized epilepsy is the most prevalent in accidents related to head strikes (Steinmetz, Tipold and Löscher, 2013).In a study conducted in Nigeria, in 2013, the largest percentage of people with epilepsy suffered from generalized epilepsy, and one of those reasons was the effect of the factor of high blood levels of bilirubin in children, and this was similar to the results we reached in our study.(Ogunrin, Adeyekun and Adudu. 2013).Determining the type of epilepsy associated with a particular factor will greatly help in determining the treatment plan and facilitate the diagnosis process, which helps in choosing the direct medication accurately, which will therefore help to stop the recurrence of controlling it, which helps to preserve the exists of persons with epilepsy, improve the quality of life and reduce stigma.

Conclusions

This study concluded that the study showed that there is a relationship between the factors that lead to the occurrence of epilepsy and the type of epilepsy, where

5986

there was a relationship between suffocation and the type of generalized epilepsy, while the other factor was trauma during labor, which was common in generalized and partial epilepsy.

References

- Abdulkareem, A. G. (2022). Epilepsy and Child History in Dr Jamal Ahmad Rashid Pediatric Teaching Hospital Sulaimani /Iraq. *Kurdistan Journal of Applied Research*, 6(2), 117–126. https://doi.org/10.24017/science.2021.2.11
- Barker-Haliski, M., Sills, G. J., & White, H. S. (2014). What are the arguments for and against rational therapy for epilepsy? Advances in Experimental Medicine and Biology, 813, 295–308. https://doi.org/10.1007/978-94-17-8914-1_24
- 3. Berg, A. T., Jallon, P., & Preux, P. M. (2013). The epidemiology of seizure disorders in infancy and childhood: Definitions and classifications. In Handbook of Clinical Neurology (1st ed., Vol. 111). Elsevier B.V. https://doi.org/10.1016/B978-0-444-52891-9.00043-9
- 4. Camfield P, & Camfield C. (2015). Incidence, prevalence and aetiology of seizures. Epileptic Disord, 17(2), 117–123.
- 5. Chowdhury, R. N. (2014). Precipitating factor of seizure in epilepsy: experience in a tertiary care hospital. *Europepmc*. https://europepmc.org/article/med/24584374#impact
- Fiest, K. M., Sauro, K. M., Wiebe, S., Patten, S. B., Dykeman, J., Pringsheim, T., & Lorenzetti, D. L. (2016). Prevalence and incidence of epilepsy A systematic review and meta-analysis of international studies.
- Fisher, R. S., & Bonner, A. M. (2018). The Revised Definition and Classification of Epilepsy for Neurodiagnostic Technologists. Neurodiagnostic Journal, 58(1), 1–10. https://doi.org/10.1080/21646821.2018.1428455
- 8. Glozman, J. (2013). Developmental neuropsychology. In Developmental Neuropsychology. https://doi.org/10.4324/9780203081181
- Goldberg, E. M., & Coulter, D. A. (2013). Mechanisms of epileptogenesis: A convergence on neural circuit dysfunction. Nature Reviews Neuroscience, 14(5), 337-349. https://doi.org/10.1038/nrn3482
- 10. Guo, D., Zeng, L., Brody, D. L., & Wong, M. (2013). Rapamycin Attenuates the Development of Posttraumatic Epilepsy in a Mouse Model of Traumatic Brain Injury. PLoS ONE, 8(5). https://doi.org/10.1371/journal.pone.0064078
- Iacone, Y., Morais, T. P., David, F., Delicata, F., Sandle, J., Raffai, T., Parri, H. R., Weisser, J. J., Bundgaard, C., Klewe, I. V., Tamás, G., Thomsen, M. S., Crunelli, V., & Lőrincz, M. L. (2021). Systemic administration of ivabradine, a hyperpolarization-activated cyclic nucleotide-gated channel inhibitor, blocks spontaneous absence seizures. Epilepsia, 62(7), 1729–1743. https://doi.org/10.1111/epi.16926
- 12. Jebur, N. J., Jumaa, A. K., & Hussain, S. A. (2021). Knowledge, Awareness and Attitude of Pharmacy Students towards Epilepsy in Iraq. Medico Legal Update, 21(2), 1333–1343. https://doi.org/10.37506/mlu.v21i2.2877
- Keezer, M. R., Sisodiya, S. M., & Sander, J. W. (2016). Comorbidities of epilepsy: Current concepts and future perspectives. The Lancet Neurology, 15(1), 106–115. https://doi.org/10.1016/S1474-4422(15)00225-2

- 14. Kumar, M., & Kalita, J. (2018). Seizures in tuberculous meningitis.pdf.
- 15. Löscher, W. (2011). Critical review of current animal models of seizures and epilepsy used in the discovery and development of new antiepileptic drugs. Seizure, 20(5), 359–368. https://doi.org/10.1016/j.seizure.2011.01.003
- Mishra, O. P., Upadhyay, A., Prasad, R., Upadhyay, S. K., & Piplani, S. K. (2017). Behavioral problems in Indian children with epilepsy. Indian Pediatrics, 54(2), 116–120. https://doi.org/10.1007/s13312-017-1012-7
- 17. Nimesh, S., Tomar, R., Kumar, M., Tyagi, N., & Shukla, P. K. (2019). A pharmacovigilance study of monitoring & focusing of adverse drug reactions induced by antiepileptic drugs used in epileptic patients. Pharmacy & Pharmacology International Journal, 7(3), 100–104. https://doi.org/10.15406/ppij.2019.07.00238
- Nomura, S., Koizumi, H., Suehiro, E., Kiya, H., & Suzuki, M. (2016). Unique distribution of benzodiazepine receptors in the brain during the first two years of life. Pediatric Neurosurgery, 51(5), 244–248. https://doi.org/10.1159/000445903
- 19. Ogunrin, O. A., Adeyekun, A., & Adudu, P. (2013). Etiologies of epilepsy and health-seeking itinerary of patients with epilepsy in a resource poor setting: Analysis of 342 Nigerian Africans. *Seizure*, 22(7), 572–576. https://doi.org/10.1016/j.seizure.2013.04.012
- 20. Pavlou, E., & Gkampeta, A. (2011). Learning disorders in children with epilepsy. Child's Nervous System, 27(3), 373-379. https://doi.org/10.1007/s00381-010-1321-9
- 21. Perucca, E., Covanis, A., & Dua, T. (2014). Commentary: Epilepsy is a global problem. Epilepsia, 55(9), 1326–1328. https://doi.org/10.1111/epi.12725
- 22. Perucca, P., Camfield, P., & Camfield, C. (2014). Does gender influence susceptibility and consequences of acquired epilepsies?
- Powell, K. L., Fitzgerald, X., Shallue, C., Jovanovska, V., Klugmann, M., Von Jonquieres, G., O'Brien, T. J., & Morris, M. J. (2018). Gene therapy mediated seizure suppression in Genetic Generalised Epilepsy: Neuropeptide Y overexpression in a rat model. Neurobiology of Disease, 113(January), 23–32. https://doi.org/10.1016/j.nbd.2018.01.016
- 24. Ryvlin, P., Cross, J. H., & Rheims, S. (2014). Epilepsy surgery in children and adults. The Lancet Neurology, 13(11), 1114–1126. https://doi.org/10.1016/S1474-4422(14)70156-5
- Sampaio, L. P. B., Caboclo, L. O. S. F., Kuramoto, K., Reche, Â., Yacubian, E. M. T., & Manreza, M. L. G. (2010). Prevalence of Epilepsy in Children From a Brazilian Area of High Deprivation. Pediatric Neurology, 42(2), 111–117. https://doi.org/10.1016/j.pediatrneurol.2009.09.002
- 26. Sampaio, L. P. B., Caboclo, L. O. S. F., Kuramoto, K., Reche, Â., Yacubian, E. M. T., & Manreza, M. L. G. (2010). Prevalence of Epilepsy in Children From a Brazilian Area of High Deprivation. *Pediatric Neurology*, 42(2), 111–117. https://doi.org/10.1016/j.pediatrneurol.2009.09.002
- 27. Socała, K., Szopa, A., Serefko, A., Poleszak, E., & Wlaź, P. (2021). Neuroprotective effects of coffee bioactive compounds: A review. International Journal of Molecular Sciences, 22(1), 1–64. https://doi.org/10.3390/ijms22010107
- 28. Steinmetz, S., Tipold, A., & Löscher, W. (2013). Epilepsy after head injury in dogs: A natural model of posttraumatic epilepsy. *Epilepsia*, 54(4), 580–588. https://doi.org/10.1111/epi.12071

- Tan, M. (2014). Epilepsy in adults. Australian Family Physician, 43(3), 100– 104. https://doi.org/10.1002/ana.410090103
- Valentín, A., Morris, R., Honavar, M., Bodi, I., Teijeira-Azcona, A., Lázaro, M., Selway, R., Alarcón, G., & Richardson, M. P. (2015). Single pulse electrical stimulation identifies epileptogenicity in a case with subcortical nodular heterotopia and MRI negative epilepsy. Brain Stimulation, 8(3), 672–674. https://doi.org/10.1016/j.brs.2015.01.403
- 31. Wang, Mengjie, Ding, D., Zhu, G., Zhang, Q., Wang, T., Chen, Y., Wang, W., Hong, Z., Li, S., & Sander, J. W. (2019). Prevalence of epilepsy in rural China: A decreasing trend over 12 years. Journal of Neurology, Neurosurgery and Psychiatry, 90(11), 1289–1291. https://doi.org/10.1136/jnnp-2018-320131
- 32. Weckhuysen, S., Marsan, E., Lambrecq, V., Marchal, C., Morin-Brureau, M., An-Gourfinkel, I., Baulac, M., Fohlen, M., Kallay Zetchi, C., Seeck, M., De La Grange, P., Dermaut, B., Meurs, A., Thomas, P., Chassoux, F., Leguern, E., Picard, F., & Baulac, S. (2016). Involvement of GATOR complex genes in familial focal epilepsies and focal cortical dysplasia. Epilepsia, 57(6), 994– 1003. https://doi.org/10.1111/epi.13391
- 33. Yuen, A. W. C., Keezer, M. R., & Sander, J. W. (2018). Epilepsy is a neurological and a systemic disorder. Epilepsy and Behavior, 78, 57-61. https://doi.org/10.1016/j.yebeh.2017.10.010
- 34. Zentner, J. (2012). Surgical treatment of epilepsies. In Acta Neurochirurgica, Supplement (Issue 84). https://doi.org/10.1007/978-3-7091-6117-3_3
- 35. Zhu, Q., Guo, Y., Ma, S., Yang, L., Lin, Z., Sun, H., Li, G., & Yu, L. (2021). Sociodemographic factors associated with the first administration of antiseizure medication in patients with focal epilepsy in Western China. BMC Neurology, 21(1), 1–7. https://doi.org/10.1186/s12883-021-02282-w