

# Relationship between epileptic seizures and criminal behavior: A Systematic Literature Review

## Relação entre crises epilépticas e comportamento criminoso

### Uma revisão sistemática da literatura

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#### ABSTRACT

**Objective:** The principal objective aims to assess a possible relationship between epilepsy and aggressive behavior. Secondly, we intend to study how epilepsy relates to criminal liability.

**Methods:** A systematic literature review was performed, using the Web of Science, United States National Library of Medicine (PubMed), and Scielo databases. The searches were conducted in May-June 2022 and covered the period from 2000 to 2022. Eligibility criteria consisted on original articles in English and Portuguese that were interested in the association of epilepsy, criminal behavior (with aggression directed to others), criminal liability in adults with epilepsy.

**Results:** The search yielded 921 results, 794 of which in PubMed, 115 in Web of Science, and 12 in Scielo. Articles that failed to meet the inclusion criteria (206) and duplicates (201) were excluded.

**Conclusion:** There were no findings to indicate a significant increase in aggressive behaviors in individuals with epilepsy. However, it was possible to identify a higher prevalence of aggressive acts in males with epilepsy, besides the presence of comorbidities with mental disorders and substance use. In addition, the results suggest that in criminal offenders with epilepsy, the seizures originated in the temporal and frontal cerebral lobes. Further research is necessary on the relationship between epilepsy, criminality, and criminal liability in order to produce more robust data to support legal proceedings.

**Keywords:** Epilepsy, Violence, Criminal Behavior, Criminal Liability.

#### RESUMO

**Objetivo:** O objetivo principal visa avaliar uma possível relação entre epilepsia e comportamento agressivo. Secundariamente, pretendemos estudar a relação entre epilepsia e responsabilidade penal.

**Método:** Foi realizada uma revisão sistematizada da literatura, utilizando as bases de dados Web of Science, United States National Library of Medicine (PubMed) e Scielo. As buscas ocorreram no período de maio e junho de 2022, verificando o período de 2000 à 2022. Os critérios de elegibilidade consistiram em artigos originais em inglês e português, com interesse na associação entre epilepsia, comportamento criminoso (com violência direcionada a outros) e responsabilidade penal em adultos com epilepsia.

**Resultados:** Foram encontrados 921 resultados na busca, sendo 794 na base de dados PubMed, 115 na Web of Science, e 12 na Scielo. Aqueles que não preencheram os critérios de inclusão (206) e duplicados (201) foram excluídos.

**Conclusão:** Não houveram achados suficientes que indicassem um aumento significativo de comportamentos agressivos na população epiléptica. Entretanto, em relação a esse aspecto, foi possível estabelecer maior prevalência no sexo masculino, presença de comorbidades com transtornos mentais, além de uso de substâncias. Além disso, os resultados sugerem que, em infratores epilépticos, as crises foram provenientes das regiões temporo-frontais do cérebro. Em suma, é importante que a relação entre comportamento criminoso, epilepsia e imputabilidade penal continue sendo estudada, de modo a trazer dados mais sólidos para embasar procedimentos judiciais.

**Palavras-chave:** Epilepsia, Comportamento Agressivo, Comportamento Criminoso, Responsabilidade Penal.

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**CONFLICT OF INTERESTS:** The authors thereby state that they have no conflict of interests.

**ACKNOWLEDGEMENTS:** No material or financial support was received for this study.

## INTRODUCTION

Epilepsy is a neurological disorder characterized by the brain's persistent predisposition to generate epileptic seizures<sup>1</sup>. An epileptic seizure is a sudden and brief change of behavior caused by an abnormal electric discharge in the cerebral cortex<sup>2</sup>.

There are various potential causes of epileptic seizures, including hereditary factors, those that occur in individuals with no other neurological disorder, and secondary to brain lesions<sup>3</sup>. Although most seizures occur spontaneously, certain internal or environmental factors can trigger it<sup>4</sup>. The most common precipitating factors are sleep deprivation, emotional distress, menstrual period, physical exhaustion, hot or cold climate, and alcohol consumption.

Psychiatric manifestations can occur in ictal, post-ictal and interictal period, such as anxiety, panic, depression, and, less frequently, euphoria reaction<sup>5</sup>. Individuals with epilepsy have higher prevalence rates of mental disorders when compared to the general population<sup>6</sup>.

Psychosocial problems such as constraints in lifestyle, low self-esteem, stigma, limitations in vocations and educational achievement, poor social support and dependence on others for socioeconomic needs, underlie people with epilepsy<sup>7</sup>. It is well documented in scientific literature that people with psychosocial vulnerability are prone to engage in criminal acts when compared to people without vulnerability<sup>7</sup>.

The association between epilepsy and behavioral disorders such as aggressiveness has been the object of much discussion since the 19<sup>th</sup> century<sup>8</sup>. Cesare Lombroso hypothesized the existence of epileptoid and hereditary traits. The idea that epileptic individuals are prone to violent acts and aggressive behavior<sup>9</sup> was perpetuated for years in Criminology, sparking numerous controversies<sup>10, 11</sup>.

In law enforcement and justice system from many countries, when an association is proven between epilepsy and criminal acts, it can be used as a legal defense or as an attenuating factor for offenders with epilepsy<sup>12</sup>.

In Brazilian legal system, there are three conditions necessary for an individual to be considered liable of a crime: to perpetrate a crime, to understand the criminal nature of the act at the time it was committed, and to have been free to choose between committing it or not<sup>13</sup>. When these criteria are not met, an individual can be considered partially or entirely non-liable.

A person is considered responsible but not criminally liable when he or she is partially considered capable of understanding the criminal nature of the act and/or partially capable of determining his or her own conduct<sup>14, 15</sup>. When an individual has committed a criminal act but cannot be held account for it, he or she is considered non-liable<sup>16</sup>. Brazilian Criminal Code<sup>17</sup> states in Article 26 on non-liability:

"Article 26—An individual is considered non-liable when, due to mental illness or incomplete or delayed mental development, they were, at the time of the act or omission, entirely incapable of understanding the illegal nature thereby or of determining their conduct according to such understanding.

Sole paragraph—The sentence may be reduced by one to two thirds if the individual, due to a mental health disturbance, incomplete mental development, or absolute inability to understand the illegal nature of the act, is incapable of determining their conduct according to such understanding."

The criminal liability of a perpetrator with epilepsy depends on their understanding and decision-making capacity at the time of the crime<sup>11</sup>. Also, the majority of epileptic disorders can be controlled with medication, thereby making it possible for a person with epilepsy to have full criminal responsibility of its acts<sup>16</sup>. There is a debate whether the neurological harms caused by seizures can trigger aggressive traits and heightened impulsivity, jeopardizing their capacity for self-determination (volitional component)<sup>18</sup>. Other factor that can lead to criminal behavior are psychosocial problems. Studies have shown that persons with epilepsy display more psychosocial problems than the general population<sup>19</sup>.

The Western World has already made advances in the protection, clinical and legal management of persons with epilepsy, while these civil rights are still incipient in the East. Individuals with epilepsy suffer inadequate legal protection, reflecting a lack of understanding among the lay public<sup>20</sup>. There is no legal safeguards for people with epilepsy.

There is no consensus on how epilepsy and its behavioral symptoms can affect criminal offences occurrence. Hence, how the courts will manage its criminal liability is uncertain. A few studies have addressed the prevalence of aggressive behaviors in persons with epilepsy, though the majority of recent studies are case reports<sup>4, 12, 21-27</sup>. The area lacks robust research with methodological strength and data that can be generalized. Generally, the main limitation of the research is related to the difficulty of establishing accurately if a subject had experienced a seizure close to the time of the criminal act<sup>12</sup>. In incarcerated population, studies have showed prevalence rates two to four times higher than in the general population<sup>28-30</sup>.

The relationship between epilepsy and violence has been the centre of discussion for over a century. The primary objective of the current study aims to assess a possible relationship between epilepsy and criminal behavior. Secondly, we intend to study how epilepsy relates to criminal liability.

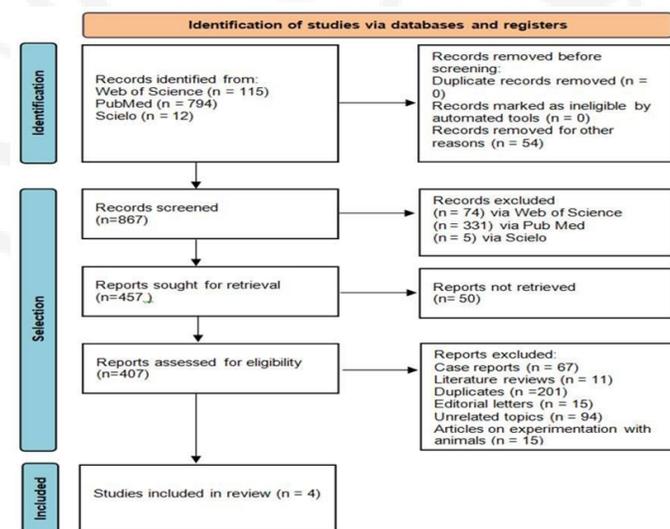
**MATERIAL AND METHODS**

The search strategy followed the PRISMA checklist<sup>30</sup>. A systematic literature review was performed, using Web of Science, PubMed/Medline, and Scielo databases. The search included articles published from 2000 to May 2022. Eligibility criteria consisted on original articles in English and Portuguese that were interested in the association of epilepsy, criminal behavior (with violence directed to others) and criminal liability in adults with epilepsy. Search terms were epilepsy, homicide, crime, murder, violence, delinquency, criminal responsibility, legal outcome, criminal evaluation, ictal aggression, and criminal liability in English and the equivalent terms in Portuguese. The searches were conducted using “epilepsy” and the Boolean operators “AND” and “OR” with the other terms in English and then “epilepsia” and the other terms in Portuguese. The keywords were used in “all fields” in the search for articles, and not only in the abstracts. This strategy was used due to the scarcity of publications.

The search excluded case reports, articles repeated in the selected databases, articles in languages other than English and Portuguese, those involving experimentation in animals, and opinion articles, in addition to literature review articles. Research results that were only published or accessible in abstract form were not included. The article selection did not undergo evaluation by independent reviewers, and no automated selection tools were used.

**RESULTS**

The search yielded 921 publications, 115 on Web of Science, 794 on PubMed, and 12 on Scielo. Articles that failed to meet the inclusion criteria (471) and duplicates (231) were excluded. Figure 1 shows the flowchart for the article selection process.



Figures 1. Flowchart of the article selection process.

According to the inclusion and exclusion criteria, four articles were selected. The summary results are shown in Table 1 (Included articles).

**Table 1.** Articles included: relationship between epilepsy, criminal behavior and criminal liability

| Authors   | Year         | Country        | Study design                               | Study population  | Sample            | Cases and controls   | Malstead year | Conclusions   | Statistically significant differences between the groups |
|---|--------------|----------------|--|---|-------------------|--|---------------|---|--|
| Bogdanovic et al. <sup>32</sup><br>Kim et al. <sup>33</sup> | 2000<br>2010 | United Kingdom | Retrospective study<br>Retrospective study | Residents at a residential epilepsy centre<br>Criminal patients of forensic hospital  | (n=99)<br>(n=761) | Group of aggressive residents and age- and sex-matched control subjects (remaining residents)<br>Group of patients with epilepsy who had committed violent crimes (1% of the hospital's patient) and no controls |               | Prevalence of aggression to be 27.2% in 1 year amongst long-term residents. The overall frequency was estimated at between 121 and 207 incidents per 100 persons per year.<br>Of 761 criminals admitted to the facility, 17 were diagnosed with epilepsy (2.2%). All 17 participants presented localization-related epilepsy, involving either frontal lobe epilepsy or temporal lobe epilepsy. | No   |
| Fazel et al. <sup>34</sup>                                  | 2011         | Sweden         | Longitudinal population-based study        | Epilepsy or traumatic brain injury patients from the National Patient Register  | (n=22,947)        | Epilepsy group.<br>Traumatic Brain Injury group and controls   |               | Epilepsy was not associated with increased risk of violent crimes.  | No   |
| Reuber et al. <sup>35</sup>                                 | 2007         | United Kingdom | Retrospective study                        | All criminal cases found "not guilty by reason of insanity" (NGRI) because of epilepsy in England and Wales between 1975 and 2000 | (n=179)           | Defendants "not guilty by reason of insanity" with epileptic automatism  |               | Thirteen (7.4%) patients in sample of individuals with epilepsy were found not liable due to mental illness. It is atypical for epileptic seizures to be associated with criminal acts. There were no definitive examples of criminal behavior.   | No   |

Bogdanovic *et al.*<sup>32</sup> studied episodes of aggression in one year in a residential epilepsy facility, comparing aggressive versus non-aggressive residents, matched by sex and age. Prevalence of aggressive behaviors in long-term residents was 27.2%. 70.4% of residents who committed aggressive acts were males, but when compared to the controlled-subjects group there was no statistical significance (p = N-S). Still, offenders were younger (M = 33 years) than non-offenders (M = 49 years). Frequency of seizures, time since onset of epilepsy, brain abnormalities seen on magnetic resonance imaging, and history of psychosis did not differ significantly between aggressive versus non-aggressive residents of the epilepsy facility.

Kim *et al.*<sup>33</sup> evaluated the clinical and criminal characteristics of epileptic patients of a forensic hospital who committed violent crimes. Of 761 criminals admitted to the facility, 17 were diagnosed with epilepsy (2.2%). All 17 participants presented localization-related epilepsy, involving either frontal or temporal lobe epilepsy. Most patients reported no loss of consciousness or memory during the crime. Violent crimes were rarely committed in the ictal or postictal periods, which suggest that most violent crimes took place during interictal periods. The study showed that different factors such as inebriation, psychosis and low intelligence were associated with violent crimes among epileptic patients.

Fazel *et al.*<sup>34</sup> found a 1.4-1.7% increase in risk of violent crimes in persons with epilepsy compared to the control group. However, this association disappeared when persons with epilepsy were compared to their siblings without epilepsy (in example, the risk was attenuated). In addition, epilepsy subtypes involving loss of consciousness (complex partial seizures and generalized epilepsy) were associated with lower crime rates. The study showed that epilepsy was not associated with increased risk of violent crimes and thus did not demonstrate a causal link between

the disease and criminality.

Reuber *et al.*<sup>35</sup> analyzed cases in which the verdict was "not guilty by reason of insanity" through data extracted from medical and legal reports in a mental health facility in England and Wales, covering the period from 1975 to 2001. Thirteen (7.3%) of the 179 participants considered not liable on grounds of insanity had a diagnosis of epilepsy. 92% of the epileptic individuals were males, and 85% had psychiatric comorbidities. The study suggests that most of the offenses related to epilepsy are likely to have occurred in postictal phase. This research concluded that it is exceptional for epileptic seizures to cause criminal acts or omissions.

## DISCUSSION

The major finding of this study is the lack of a positive correlation between epilepsy and crime. Although the secondary objective of this work was to study criminal liability in people with epilepsy, the findings in the literature were mostly on the association between epilepsy and criminality/violence, rather than on the determination of criminal liability in persons with epilepsy after committing a criminal offense.

Half of the studies included in this research identified an increased prevalence of criminal behaviors in male participants with epilepsy<sup>32,35</sup>. In regards to the relationship between localization-related seizures and aggressive behaviors, one study reported the prevalence of temporal and frontal lobe involvement<sup>33</sup>. There was no conclusive evidence concerning cerebral hemispheric laterality.

In addition, substance use prior to the offense, especially alcohol consumption, was present in the great majority of cases. Substance use may thus trigger violent behaviors in those people. The high prevalence of psychiatric comorbidities<sup>33,35</sup> could heighten the manifestation of behavioral disturbances in people with epilepsy<sup>12</sup>.

The importance of violence prevention through adequate treatment and control of seizures, besides information-sharing on how to recognize and deal with epileptic seizures, which are often mistaken for "strange behaviors" was pointed in one study<sup>34</sup>. Hyperkinesia, shouts, and vigorous gestures during convulsions may appear violent<sup>36</sup>. Such manifestations may cause aggressive reactions from public or law enforcement personnel and thus result in conflicts.

In some cases, epilepsy can be used for the person's defense in criminal proceedings as a way of obtaining security measures or attenuation of the sentence. This illustrates the importance of forensic psychiatric examination, for the court system to adopt the appropriate security measures and criminal and correctional sanctions<sup>17</sup>. The forensic psychiatric assessment requires analyzing the person's mental status

and the social context in which the violent act occurs<sup>9</sup>.

In this sense, it is essential to carry out a psychiatric investigation of criminal liability, with a survey of the type of epilepsy that a given individual has, the treatments performed and the response to them, as well as a detailed retrospective assessment of the aggression at the time that the offence occurred. Only this way will it be possible to establish fair and adequate penalties or corrections for each individual.

## CONCLUSION

Based on this review's findings, it was not possible to establish an association between epilepsy, criminality, and especially criminal liability. It seems that the relationship between epilepsy, crime, and criminal liability is a complex legal and medical issue that goes beyond the limits of the current study. The review features interesting observations: the literature on the relationship between epileptic seizures and criminal acts is inconclusive. In relation to the localization of seizures, the findings show that the temporal and frontal regions are likely to be the most affected ones. Behavioral disorders appear to be more closely related to the comorbidities of epilepsy than to the seizures' particular characteristics. Such comorbidities are often not well-described in the studies, despite this issue's importance.

The relationship between epileptic seizures and aggressive behavior is complex and can vary from person to person. Some individuals may experience unintended changes in behavior related to seizures (altered consciousness or confusion), brain function deficit, medication or psychological factors. However, it seems that aggressive behavior is not a common symptom of epilepsy, and most people with epilepsy do not have aggressive tendencies and is involved in criminal offences. In addition, side effects associated with medication, as some antiepileptic drugs can influence mood and behavior. Furthermore, there are potential psychiatric comorbidities, as people with epilepsy may have higher rates of them that may be associated with aggressive behavior.

Aggressive behavior is likely to be influenced by a combination of factors, including individual's neurological profile, general health, and environment. Consequently, proper assessment and management can help identify underlying risk factors for eventual aggressive behavior to be managed to improve the individual's well-being.

Finally, there was no sufficient evidence of a causal or correlation link between epilepsy and criminal behavior. Thus, the assessment of criminal liability in these cases finds little backing in the literature. Methodological diversity, quantitative and qualitative aspects, data gathering and reporting rendered a difficult comparison between studies and generalization of the results. New studies and further research is necessary to clarify the

association between epilepsy and criminal behavior.

**INDIVIDUAL CONTRIBUTIONS:** Julia Bulhões Schechtman: research project conceptualization and data analysis and interpretation; revision of the article's content; approval of the final version for publication. Mauro Vitor Mendlowicz, Antonio Egidio Nardi and Alexandre Martins Valença: data analysis and interpretation; revision of the article's content; approval of the final version for publication.

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