

## DRIVING ISSUES IN EPILEPSY: PAST, PRESENT, AND FUTURE

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*Driving restrictions for people with seizure disorders are intended to ensure the public's safety, but driving is of such great importance in the United States that the imposed restrictions also may unduly harm the welfare of these individuals. Because driving restrictions historically have been based more on expert opinion than sound scientific evidence, the appropriateness and application of standards for licensing drivers with seizures continue to raise questions and concerns, as does the role physicians should have in the process. Driving is an important and complex practical concern for physicians who care for people with epilepsy or who may serve as consultants to regulatory authorities, requiring them to be well informed about the relevant issues to properly manage their patients and to protect themselves against lawsuits.*

Driving poses daily challenges for many people with epilepsy. Driving a car is so critical to employment, socialization, and self-esteem—all aspects central to modern life in the United States—that people with epilepsy list it as a top concern in surveys (1). Despite the desire and need of individuals with epilepsy to drive, seizures while driving pose the risk of a crash, which may result in property damage, injuries, and even deaths (2–6). These risks are somewhat predictable based on identifiable factors, such as relative seizure frequency (2,5,8). Therefore, in the United States and most other countries, people with controlled epilepsy are permitted to drive but only with legal restrictions (2,3). The specific restrictions and rules vary widely among states and remain controversial because they are largely based on expert opinion, practical experience, and political necessity rather than on strong scientific evidence (2,3,7). Physicians are involved in the issue of driving and seizure risk

in various ways, including as healthcare providers, advisors to people with epilepsy, and consultants to regulatory authorities; and all these roles expose physicians to the risk of being sued (2–4). Physicians, patients, and regulators share the responsibility of protecting public safety, while still providing reasonable opportunity for individuals with seizures to drive an automobile; therefore, they need to stay informed about the subject (2,3,7). This review discusses the history, scientific evidence, current practices, as well as the future opportunities and challenges inherent in regulating drivers with seizures and epilepsy.

### History of Restrictions and Regulations for Drivers with Seizures or Epilepsy

When motorcars were first introduced to the public in the late 1800s, some medical conditions, including epilepsy, were recognized to pose risks for driving (4). Consequently, when licenses became obligatory, people with seizures or epilepsy were among the individuals with medical conditions who were routinely omitted from consideration. However, by the late 1940s, it became evident that many people with epilepsy would over time stop having seizures, or the seizures could be completely controlled with medications, and therefore, these patients were potentially safe drivers (4). The determination of seizure control that is sufficient to permit licensure to drive largely has been based on a seizure-free period, but other factors were and still are considered (see Tables 1 and 2) (3,4,7).

Many studies confirm that epilepsy poses some driving risk (5,6,8–10), but that risk seems limited and relatively small, particularly compared with alcohol (2,6,7). For instance, one study estimated that the percentage of fatal driver crashes caused by a seizure is only 0.2% as compared with 30% caused by alcohol (6); other studies concur that seizures pose a relatively low risk for fatal crashes (2,7). Most investigations have demonstrated that the risk for any type of crash is estimated to be nearly two-fold higher for people with epilepsy than for the general population (11–13). However, that risk level was determined based on crashes for all causes rather than just seizure-related crashes, which ought to be the most relevant concern in licensing drivers with epilepsy. In fact, it has been reported that only 11% of all car crashes involving individuals with epilepsy are due to seizures (13). Indeed, most car accidents involving people with epilepsy are not caused by a seizure but are due to driver error, just as occurs in the majority of crashes in the general population (11–13). Studies of large populations of drivers confirm that the risk of crashing for individuals with epilepsy is not substantially higher than for those with other

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**TABLE 1.** Selected Favorable Modifiers for Shortening a Proposed 3-Month, Seizure-Free Interval Requirement\*

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- Seizures during medically directed changes in medication
  - Simple seizures that do not interfere with consciousness or motor function
  - Seizures with consistent and prolonged auras
  - Seizures related to acute toxic or metabolic states or illnesses that are not likely to recur
  - Established pattern of pure nocturnal seizures
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\*Adapted from consensus statements (7).

chronic medical conditions, such as heart disease, diabetes, or even for certain classes of drivers, such as young males, all of which are less regulated than epilepsy (10–14). Evidence supports the view that a seizure while driving is dangerous, but the risk is relatively limited and somewhat predictable. Therefore, current public policies regulating drivers with epilepsy, but permitting patients with controlled seizures to drive, are justified.

### Present Standards, Regulations, and Practices

Today, every state in the United States permits people with controlled seizures to drive (2,3). The particular legal rules for determining and administering driving privileges are a complex and often confusing mix of federal and state laws, regulations, and local practices that vary widely across the country (2,3). In general, the rules attempt to limit licensing for those people whose epilepsy puts them at greatest risk for having seizures while driving. The primary standard for determining that risk is the seizure-free interval, that is, the duration of time a person has gone without a seizure (2,3). Essentially, the standard dictates that a person with a history of seizures or epilepsy may drive if that individual has had no seizures for a time period adequate to demonstrate that a seizure recurrence while driving is of sufficiently low probability. Some states give physicians case-by-case discretion to recommend a specific period of seizure freedom or other requirements before licensing a driver with epilepsy,

**TABLE 2.** Selected Unfavorable Modifiers for Lengthening a Proposed 3-Month, Seizure-Free Interval Requirement\*

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- Noncompliance with medication or medical visits, or lack of credibility
  - Recent history of active alcohol or drug abuse
  - Structural brain disease
  - Uncorrectable brain functional or metabolic disorder
  - Frequent seizure recurrences after seizure-free intervals
  - Prior crashes caused by seizures
  - Previous bad driving record
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\*Adapted from consensus statements (7).

yet these doctors generally recommend similar seizure-free intervals and other standards as those required by states with less discretionary rules (3).

The emphasis on the seizure-free interval is warranted and widely supported by the literature (2,4,7). For example, one study showed that the duration of the seizure-free interval is the strongest predictor of risk of a seizure-related crash (5). Although it is generally accepted that the seizure-free interval is a key determinant for licensing drivers, the exact duration of the legally required seizure-free interval is the subject of considerable debate (2–4,7). Scientific research on this topic is limited, but a 6–12 month seizure-free interval has been reported in one study to be associated with significantly reduced odds of crashing as a result of a seizure, as compared with shorter intervals (5). This study does not specify how these seizure-free intervals translate either into crashes or into undue hardship by prohibiting driving for people with epilepsy who will not crash, which is an important trade-off to consider. Some limited estimates can be derived from the study's results: adherence to a 12-month seizure-free interval was estimated to prevent about 80% of all crashes associated with seizures, but it also would prohibit driving for about 50% of all those with epilepsy who would not crash. In contrast, a 3-month seizure-free requirement prevents 50% of crashes but prohibits driving for only 25% of individuals who would not crash (5). In the United States, the required time period for seizure-freedom ranges from about 3 to 12 months, depending on individual state laws (3). However, a 3-month seizure-free interval is recommended in the consensus statement issued by the American Academy of Neurology (AAN), American Epilepsy Society (AES), and the Epilepsy Foundation (EF) (7).

In general, relatively short seizure-free intervals have an advantage for promoting patients' compliance with legal restrictions. Noncompliance with legal standards is a major problem in the regulation of drivers with medical conditions like epilepsy (2,3,15,16). Indeed, studies indicate that approximately half of all drivers do not report their epilepsy to regulators, as required (2,5,8,15,16). Importantly, noncompliance likely dilutes the public safety value of longer seizure-free intervals. More permissive restrictions (i.e., shorter seizure-free intervals), although potentially increasing an individual's risk of a seizure-related crash, may actually reduce the cumulative crash risk posed by epilepsy on the whole, as it promotes better compliance with legal driving restrictions among all people with seizures (2). In support of this theory, one study found that a 3-month seizure-free interval did not significantly increase the incidence of car crashes and deaths from seizures in the 3 years following implementation, as compared with a 1-year seizure-free requirement (17); another report found no difference in driver fatalities in states with short (i.e., 3-months) as compared with longer (i.e., 6- or 12-months) seizure-free requirements (6).

Although the key measure in determining licensure, the seizure-free interval, nonetheless is only one factor to be considered in setting standards (2,3,5,7). Several favorable and unfavorable modifiers were proposed by the consensus statement of the AES, AAN, and EF for consideration in an evaluation to shorten or lengthen the duration of a required seizure-free interval (see Tables 1 and 2) (7). There is some scientific validation for a multifactorial approach to ascertaining optimal driving restrictions for people with seizures; it comes from a study confirming that some of the factors listed in Tables 1 and 2—particularly the seizure-free interval, reliable auras, and previous history of crashes from a seizure—do correlate with the risk for seizure-related crashes (5).

### **Reporting Requirements for Drivers with Epilepsy**

Only six states require physicians to report the names of patients with seizures to the motor vehicle administration (3). Physician groups generally oppose such mandatory reporting, fearing that patients will not be forthcoming about seizures and, thus, be improperly treated. Indeed, patients with epilepsy frequently do not inform their physicians about seizure occurrence, fearing loss of driving privileges and other social consequences (2,3,7). Comparing jurisdictions with and without mandatory reporting, there is some evidence that mandatory physician reporting increases the percentage of patients with epilepsy known to regulators but does not reduce the crash rate or improve the public's safety (18). Self-reporting by individuals with seizures is already required throughout the United States, with individual state motor vehicle administrations overseeing the policy. Patient noncompliance with required self-reporting is obviously a major limitation to the efficacy of this law (2,5,8,15,16).

### **Other Driving Issues in Epilepsy**

Physicians are involved in regulating driving for seizure patients in several ways that may pose a legal jeopardy for them. For example, doctors are asked to supply medical reports to motor vehicle bureaus and, in some states, recommend explicit driving restrictions (2,3,7). In general, physician liability for certifying that a patient may be licensed to drive is minimal, as long as the recommendation is reasonable and consistent with the prevailing standard of care (2,3,7). Physicians are medical experts, and suspending driving privileges is the sole legal prerogative of the state. Physicians have a duty to inform their seizure patients of the laws in their state and can protect themselves legally by documenting the discussion in the patient's medical record (2,7). Documentation need not be complicated, but for legal protection, it does need to be in the patient's record. One study demonstrated that only 21% of all adult first seizure patients received correct advice about legal driving limitations

(19). Physicians also have an important role in informing patients about the risks of driving with epilepsy as well as alternatives to driving, such as public transportation and services offered by social agencies or community resources. Physicians and patients can find information about state specific rules on driving and epilepsy and other resources from the EF on its website at [www.epilepsyfoundation.org](http://www.epilepsyfoundation.org) or from its regional affiliates. People with epilepsy face problems with automobile insurance because insurance companies may not insure them or may charge high rates. Some states offer high-risk insurance pools that provide better access and lower costs for people with disabilities like epilepsy. People with epilepsy are best advised to be truthful on applications for automobile insurance because falsifying information would give an insurer cause to void coverage and might jeopardize claims.

The use of antiepileptic drugs does not prohibit an individual from driving a personal vehicle, but discontinuation of the medications is a matter of some concern, with some physicians advising patients not to drive or limit driving while tapering off or discontinuing medications (2,7). However, generally notification of a discontinuation or change in medications is not required by state regulations (3). Nonetheless, it seems prudent for physicians to advise or warn patients about the increased risk of seizure recurrence when medications are reduced or stopped. If seizures recur after antiepileptic drugs are discontinued, several states make special allowance for early resumption of driving privileges once medications are restarted (3,7).

### **Commercial Driving Rules**

In the United States, commercial driving restrictions for people with seizures or epilepsy differ from those pertaining to use of personal vehicles (20). Federal regulations specifically prohibit interstate commercial driving licensure for individuals with epilepsy, unless that person has been off seizure medication and seizure-free for at least 10 years (20). A person with a single unprovoked seizure must be off seizure medication and seizure-free for at least 5 years. Currently, people taking anticonvulsant medications are unconditionally prohibited from licensure for interstate commercial driving (20,21). State laws for intrastate (i.e., not across state lines) commercial driving have gradually shifted to the federal standard (20,21).

The federal rules for interstate commercial drivers are currently under review and open for comment after similar, but somewhat more liberal, guidelines were proposed to Department of Transportation by an expert panel (21). Members of the panel that proposed modifying the current rules, unanously supported the changes, which were based on the best evidence available. In particular, the major changes proposed are to permit licensure of some drivers taking seizure medication and to accept slightly shorter seizure-free standards than currently exist.

The panel decided that determining driving restrictions for commercial drivers with a seizure history should hinge on what degree of risk is acceptable (21), but these proposed changes have not yet been approved or accepted and continue to be debated, in part, because the acceptable degree of risk still has not been clearly established.

## Going Forward

In the future, considerable medical, epidemiological, and public policy research will be required to properly address the issue of driving and epilepsy. Current problems arise mainly from gaps in knowledge regarding driving risks for people with seizures and deficiencies in established methods of regulation, both of which also present opportunities for scientific research and public policy change. Furthermore, addressing the concerns associated with driving and epilepsy has the potential to serve as a model for dealing with similar, complex public health problems involving medical, social, and legal disciplines. There are several topics that warrant further study and investigation. For instance, as mentioned, although currently the seizure-free interval is considered the best predictor of risk for driving with epilepsy, other mitigating or modifying factors, as listed in Tables 1 and 2, can contribute to the decision for licensing (7); these variables merit further careful scientific analysis. Also, the effects of mandatory physician reporting as well as regulatory tools need to be investigated and better understood to assure that optimal standards are met, while not unnecessarily limiting patient freedom and opportunity. The needed research will require well-designed, prospective, and large population-based studies, using centralized databases. Some relevant databases exist (5), but generally those that are available have not been specifically designed or implemented to effectively address questions of driving risks and restrictions; thus, they are limited in utility. Potentially, appropriate databases also could monitor the ongoing effectiveness of regulatory policies on public safety and permit comparisons of varying state regulations and policies (5).

Promotion of public safety and transportation for people with seizures require good and reliable alternatives to driving an automobile. Some individuals with seizures will never meet the criteria to drive, and no society seeks to license individuals with uncontrolled epilepsy, who are at high risk of having a driving accident. Therefore, a good goal for any community would be to improve public transportation and other alternatives, including state subsidized taxi services. In addition, future technological advances may help the development of so-called "smart cars" that do not require a driver for guidance or control. Finally, physicians will need to continue to work both individually and collectively through professional organizations to improve regulations for drivers with epilepsy and seizures. Involved

and knowledgeable professionals can help define best practices through evidence-based guideline development and can advocate for patients' welfare. On an individual basis, physicians can provide informed opinions and constructive criticisms to regulators and policymakers as well as to patients and their families. Volunteering to serve on review panels at local state and federal levels can help assure that the policies are fair and applied reasonably. To be most effective and helpful to patients, physicians will need to remain knowledgeable and engaged at all levels.

## References

1. Gilliam F, Gilliam F, Kuzniecky R, Faught E, Black L, Carpenter G, Schrodt R. Patient-validated content of epilepsy-specific quality-of-life measurement. *Epilepsia* 1997;38:233–236.
2. Krumholz A, Fisher RS, Lesser RP, Hauser WA. Driving and epilepsy: A review and reappraisal. *JAMA* 1991;265:622–626.
3. Krauss GK, Ampaw L, Krumholz A. Individual state driving restrictions for people with epilepsy in the US. *Neurology* 2001;57:1780–1785.
4. Krumholz A. Driving and Epilepsy: A historical perspective and review of current regulations. *Epilepsia* 1994;35:668–674.
5. Krauss GK, Krumholz A, Carter RC, Kaplan P. Risk factors for seizure-related motor vehicle crashes in patients with epilepsy. *Neurology* 1999;52:1324–1329.
6. Sheth SG, Krauss G, Krumholz A, Li G. Mortality in epilepsy: Driving fatalities vs. other causes of death in patients with epilepsy. *Neurology* 2004;63:1002–1007.
7. American Academy of Neurology, American Epilepsy Society, Epilepsy Foundation of America. Consensus statements, sample statutory provisions, and model regulations regarding driver licensing and epilepsy. *Epilepsia* 1994;35:696–705.
8. Berg AT, Vickrey BG, Sperling MR, Langfitt JT, Bazil CW, Shinnar S, Parcia S, Spencer SS. Driving in adults with refractory localization-related epilepsy. Multi-center study of epilepsy surgery. *Neurology* 2000;54:625–30.
9. Gastaut H, Zifkin BG. The risk of automobile accidents with seizures occurring while driving: Relation to seizure type. *Neurology* 1987;37:1613–1616.
10. Taylor J, Chadwick D, Johnson T. Risks of accidents in drivers with epilepsy. *J Neurol Neurosurg Psychiatry* 1996;60:621–627.
11. Waller JA. Chronic medical conditions and traffic safety. *N Eng Med J* 1965;273:1413–1420.
12. Crancer A Jr, McMurray L. Accident and violation rates in Washington's medically restricted drivers. *JAMA* 1968;205:74–79.
13. Hansotia P, Broste SK. The effect of epilepsy or diabetes on the risk of automobile accidents. *N Eng J Med* 1991;324:22–26.
14. Masland RL. The physician's responsibility for epileptic drivers. *Ann Neurol* 1978;4:485–486.
15. Dalrymple J, Appleby J. Cross sectional study of reporting of epileptic seizures to general practitioners. *Br Med J* 2000 Jan 8;320:94–97.

16. van der Lugt PJM. Is an application form useful to select patients with epilepsy who may drive? *Epilepsia* 1975;16:743–746.
17. Drazkowski JF, Fisher RS, Sirven JI, Demaerschalk BM, Uberzak L, Hentz JG, Labine D. Seizure-related motor vehicle crashes in Arizona before and after reducing the driving restriction from 12 to 3 months. *Mayo Clin Proc* 2003;78:819.
18. McLachlan RS, Starreveld E, Lee MA. Impact of mandatory physician reporting on accident risk in epilepsy. *Epilepsia* 2007;48:1500–1505.
19. Edmondstone WM. How do we manage the first seizure in adults? *J Roy Coll Phys Lond* 1995;29:289–294.
20. United States Department of Transportation. *Federal Highway Administration Regulations*. Washington, DC: Federal Highway Administration, 1983. US Department of Transportation 49 CFR section 391.41(b)(7,8,9).
21. U.S. Department of Transportation's Federal Motor Carrier Safety Administration. *Expert Panel Recommendations: Seizure Disorders and Commercial Motor Vehicle Drivers Safety*. October 2007d.