Epilepsy, seizures, physical exercise, and sports: A report from the ILAE Task Force on Sports and Epilepsy

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Summary

People with epilepsy (PWEs) are often advised against participating in sports and exercise, mostly because of fear, overprotection, and ignorance about the specific benefits and risks associated with such activities. Available evidence suggests that physical exercise and active participation in sports may favorably affect seizure control, in addition to producing broader health and psychosocial benefits. This consensus paper prepared by the International League Against Epilepsy (ILAE) Task Force on Sports and Epilepsy offers general guidance concerning participation of PWEs in sport activities, and provides suggestions on the issuance of medical fitness certificates related to involvement in different sports. Sports are divided into three categories based on potential risk of injury or death should a seizure occur: group 1, sports with no significant additional risk; group 2, sports with moderate risk to PWEs, but no risk to bystanders; and group 3, sports with major risk. Factors to be considered when advising whether a PWE can participate in specific activities include the type of sport, the probability of a seizure occurring, the type and severity of the seizures, seizure precipitating factors, the usual timing of seizure occurrence, and the person's attitude in accepting some level of risk. The Task Force on Sports and Epilepsy considers this document as a work in progress to be updated as additional data become available.

KEY WORDS: **Epilepsy, Seizures, Physical exercise, Sports, Fitness certificates.**

People with epilepsy (PWEs) have been advised often against participating in sports and exercise, mostly because of fear, overprotection, and ignorance about the benefits and risks associated with such activities.[1–3] Although the implications of engaging in sports and physical exercise for PWEs have been extensively debated, several studies reported that in most cases these activities can have a beneficial influence on seizure frequency and severity.[3] As a result, attitudes regarding sports and epilepsy have changed considerably in the last decades, as have recommendations in clinical practice.[1,3] The purpose of this consensus paper developed by the International League Against Epilepsy (ILAE) Task Force on Sports and Epilepsy is to provide general guidance concerning participation in physical exercise and specific sports for PWEs and to suggest recommendations on the issuance of medical certificates related to the practice of sports activities.

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Key Points

- Engaging in physical exercise and sport has positive effects for PWE, including increased self-esteem, socialization, and improvement in long-term general health
- PWE have often been advised against participating in sports and exercise, mostly because of fear, overprotection, and ignorance
- For most sports, there are no precise regulations that govern issuance of fitness certificates for PWE in relation to specific seizure or epilepsy types
- We propose to use as a possible guidance the regulations governing the issuance of fitness certificates for driving

Evidence on which this report is based was retrieved by searching the electronic database PubMed from January 1950 to March 2015, using the following search words: ("exercise"[MeSH Terms] OR "exercise"[All Fields]) OR "physical activity"[All Fields] OR ("sports"[MeSH Terms] OR "sports"[All Fields]) OR "physical effort"[All Fields]) AND ("epilepsy"[MeSH Terms] OR "epilepsy"[All Fields]) OR ("seizures"[MeSH Terms] OR "seizures"[All Fields]) OR "epileptiform discharge"[All Fields]). The literature search was narrowed using the following categories: randomized controlled trials; controlled clinical trials without randomization; uncontrolled clinical trials; case reports; and surveys. Exclusion criteria were dissertation abstracts because of lack of detail about methodology and outcome measures. The search was restricted to English-language articles. Of 981 articles identified by the search, 836 were rejected after reading the title and abstract because they were not considered to be relevant to the objective of this work and 128 additional articles were rejected for the same reason after reviewing the full text. The remaining 17 articles were included in this report.

Benefits and Risks of Exercise and Sports in PWEs

Determining whether a person with epilepsy can participate in specific physical activities or specific sports requires careful clinical assessment of the individual risk–benefit ratio, particularly with respect to the risk of a seizure occurring during the activity and related implications. Factors to be considered include not only the type of sport and the probability of a seizure occurring, but also individual characteristics such as the type and severity of the seizures, the consistency of any prodromal manifestations, the history concerning any seizure-precipitating factors, the likelihood of effective supervision by family members or other personnel, and the willingness of the informed PWE (or parents) to take a reasonable level of risk. A careful medical history is essential to ascertain not only the frequency and characteristics of the seizures, but also any previous seizure-related accidents or injuries, duration of periods of seizure freedom, and degree of adherence to treatment.[3] Therefore, choosing a specific physical exercise/sport for a person with epilepsy requires consideration of personal attitudes and preferences, health status, as well as medical advice. To this point, recommendations for the issuance of certificates of fitness for sports activities are needed.

In clinical studies, exercise has been reported to be associated with reduced epileptiform discharges on electroencephalography (EEG) and increased seizure threshold,[4–6] and seizures are unlikely to occur during incremental physical effort to exhaustion.[7–9] These findings are strengthened by studies in animal models of seizures and epilepsy, in which aerobic exercise training was found to retard the epileptogenic process,[10] to reduce seizure frequency,[11] and to promote favorable plastic changes in the hippocampus.[12,13] These benefits can be particularly prominent for children with epilepsy, and the involvement of these children in sports activities at school should be encouraged. Social exclusion is highly prevalent in the teen years, and teens with epilepsy are generally less physically active than their healthy siblings.[14] Furthermore, regular exercise can improve cognitive function at all ages,[15–17] and enforcing a sedentary lifestyle can have deleterious effects and impact on psychosocial development, independence, and mental health. These observations led to the general recommendation that PWEs should engage in physical exercise programs or sport activities that do not impose a significant risk of injury to themselves or to others. Assessing the risks involved in physical/sports activity participation is a responsibility to be shared among physicians, PWEs, and parents if the person with epilepsy is a child or adolescent.

A few clinical cases of seizures apparently precipitated by physical exercise have been reported, in some instances in relation to stimulus-related or reflex epilepsy syndromes.[18–20] However, a causative link between these factors and the occurrence of seizures in some of the reported instances is speculative, and, in general, sport activities are unlikely to provoke or facilitate the occurrence of seizures.

Issuance of Fitness Certificates for Specific Sports

In some countries, the ability to engage in certain sports is subject to issuance of a certificate of fitness after a preparticipation screening for all sports participants, including elite athletes.[21–29] Usually determining whether a person should be granted a fitness certificate is at the discretion of a general medical practitioner or, in certain cases, a specialist in sports medicine. In general, sports are categorized according to the risk that their practice entails not only to the participating individual, but also to others. To the best of

our knowledge, for most sports, there are no precise regulations that govern issuance of fitness certificates for PWEs in relation to specific seizure types or other clinical features. In the absence of sound epidemiologic data on the magnitude of risk for PWEs engaging in specific sports, we propose to use as a possible guidance the regulations governing the issuance of fitness certificates for driving. It is reasonable to argue that a level of risk that is compatible with the ability to drive should also be acceptable for the purpose of permitting that person to engage in any sport. Although such regulations are subject to variation both across and within countries,[30] for the purpose of the suggested recommendations, the European Union (EU) driving regulations[31] will be used as primary reference because they are applied uniformly in a large number of countries. These regulations have taken into consideration the same epidemiologic data that provided the basis for the formulation of the recently updated ILAE definition of epilepsy.[32,33] In the EU, driving license restrictions for PWEs distinguish between different epilepsy-related conditions (e.g., seizure type, duration of seizures, and remission) and driving license categories (private use of vehicles vs. professional driving). Accordingly, recommendations with respect to fitness to participate in a specific sport should take into account the probability of a seizure occurring, the seizure type, the usual timing of seizure occurrence, and other factors. Thus, we propose to classify sports into three categories based on potential risk of injury/death should a seizure occur (Tables 1 and 2). Group 1 (no significant additional risk) includes sports in which the occurrence of seizures poses no additional risk of injury for either the person with epilepsy or bystanders (other athletes, referees, or spectators). Group 2 (moderate risk) sports are those involving a moderate risk of physical injury for PWEs, but no risk for bystanders. Group 3 (major risk) sports entail a high risk of injury/death for PWEs and, for some sports, also risks for bystanders. The categorization of sports listed in Table 1 takes into account the most common conditions that are likely to apply when PWEs practice these sports, and we recognize that some sports fall in a gray zone, and that there are specific individual characteristics or circumstances for which a different categorization would be indicated, based on the judgment of the physician.

A series of different conditions will be addressed individually, including seizures that due to their nature or clinical correlates do not imply a diagnosis of epilepsy. Because of the lack of evidence from studies for specific conditions and sports, suggestions made in this report are largely opinion based, with consensus being reached for each item through extensive discussion.

People who had one or more acute symptomatic seizures

The occurrence of one or more acute symptomatic seizures, that is, seizures related to a transient factor that temporarily lowers the seizure threshold in an otherwise normal brain (for example, during a transient toxic, infectious, or metabolic derangement) does not permit a diagnosis of epilepsy, and the risk of further seizures depends on the nature and evolution of the underlying condition that caused the

Table 1. Categorization of sports by level of risk of injury or death for PWEs, or for bystanders, should a seizure occur during the event

Group 1 sports (no significant additional risk)	Group 2 sports (moderate risks to the PWEs but not to bystanders)	Group 3 sports (high risk for PWEs, and, for some sports, also for bystanders)
Athletics (except for sports listed under group 2)	Alpine skiing	Aviation
Bowling	Archery	Climbing
Most collective contact sports (judo, wrestling, etc.)	Athletics (pole vault)	Diving (platform, springboard)
Collective sports on the ground (baseball, basketball, cricket, field hockey, football, rugby, volleyball, etc.)	Biathlon, triathlon, modern pentathlon	Horse racing (competitive)
Cross-country skiing	Canoeing	Motor sports
Curling	Collective contact sports involving potentially serious injury (e.g., boxing, karate, etc)	Parachuting (and similar sports)
Dancing	Cycling	Rodeo
Golf	Fencing	Scuba diving
Racquet sports (squash, table tennis, tennis, etc.)	Gymnastics	Ski jumping
	Horse riding (e.g., Olympic equestrian events—dressage, eventing, show jumping)	Solitary sailing
	Ice hockey	Surfing, wind-surfing
	Shooting	
	Skateboarding	
	Skating	
	Snowboarding	
	Swimming	
	Water skiing	
	Weightlifting	

The categorization was done by consensus, taking into account the most common conditions that are likely to apply when PWEs practice these sports. We recognize that some sports fall in a gray zone, and that there are specific individual characteristics or circumstances for which a different categorization would be indicated, based on the judgment of the physician.

Table 2. Suggestions of physical activities/sports participation for PWEs or with other seizure disorders

	One or more symptomatic seizures	Single unprovoked seizure	Seizure-free (12 months or longer)	Sleep-related seizures only	Seizures without impaired awareness	Seizures with impaired awareness	Epilepsy resolved (no seizures >10 years and off AED > 5 years)	Medication withdrawal
Group 1 sports	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted at neurologist's discretion applies when seizures are precipitated by specific activities	Permitted	Permitted at neurologist's discretion applies when seizures are precipitated by specific activities
Group 2 sports	Permitted at neurologist's discretion, with restrictions (see text)	Permitted after 12 months of seizure freedom[a]	Permitted	Permitted at neurologist's discretion, with restrictions (see text)	Permitted at neurologist's discretion, with restrictions (see text)	Permitted at neurologist's discretion, with restrictions (see text)	Permitted	Permitted after appropriate periods following AED cessation (see text)[a]
Group 3 sports	Permitted at neurologist's discretion, with restrictions (see text)	Permitted after 12 months of seizure freedom[a]	Permitted	Generally barred, but may be considered, with restrictions, at neurologist's discretion, for sports posing no risk to bystanders (see text)	Generally barred, but may be considered, with restrictions, at neurologist's discretion, for sports posing no risk to bystanders (see text)	Generally barred, but may be considered, with restrictions, at neurologist's discretion for sports posing no risk to bystanders (see text)	Permitted	Permitted after appropriate periods following AED cessation (see text)[a]

[a]Sports for which earlier permission may apply based on the neurologist's discretion. The latter includes, in addition to informed consent, (1) evaluation of specific clinical aspects and risks related to the specific sport activity and (2) feasibility of medical surveillance and appropriate supervision during the activity. For more detailed information, see text.

seizure(s).[34] Once the causative condition is resolved, the risk of further seizures would be generally regarded as low, unless there is a high probability for the precipitating event to recur. If the risk of seizure recurrence is considered low and there are no associated contraindicating conditions, these individuals should be permitted to practice and compete immediately in group 1 sports. They may also practice and compete in group 2 and group 3 sports at the neurologist's discretion after careful medical and neurologic assessment of the risks of the causative event recurring, and with informed consent (consents for children and adolescents should be signed by parents. Minors should participate in the discussion to understand the risks and benefits associated with participation in sports. This clarification applies to all other references to "informed consent" throughout this consensus paper). Provisions may be indicated for medical follow-up as appropriate under the specific circumstances.

People who had a single unprovoked seizure

According to the ILAE practical clinical definition of epilepsy,[32,33] a single seizure considered to be associated with a ≥60% probability of recurrence within the next 10 years qualifies for a diagnosis of epilepsy.

Individuals who had a single unprovoked seizure, whether diurnal or nocturnal in origin, may practice and compete in group 1 sports immediately after an appropriate medical/neurologic assessment. The same individuals may also practice and compete in group 2 and group 3 sports after 12 months of seizure freedom, subject to an appropriate medical/neurologic assessment. They may practice and compete in some group 2 and even some group 3 sports immediately at neurologist's discretion with informed consent and under medical surveillance, and with appropriate supervision during the activity. Neurologist's discretion in the latter situation should take into account, among other considerations, prognostic factors for seizure recurrence,[33] such as the presence or the absence of a structural brain lesion considered to be potentially causative of the seizure.

PWEs who are seizure-free

After 12 months of seizure freedom, PWEs may practice and compete in all sports.

PWEs with sleep-related seizures only

PWEs whose seizures occur only during sleep may immediately practice and compete in group 1 sports. They may also be considered fit to practice and compete immediately in some group 2 sports (e.g., swimming and canoeing), at neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. They may practice and compete in all group 2 sports after 12 months of follow-up if the frequency of seizures during this period is sufficient to confirm with reasonable certainty the exclusive association of the seizures with sleep and if the sport does not involve important alterations in the wake–sleep cycle.[31] They should not practice or compete in group 3 sports that pose a danger to others. However, in those sports in which only the PWE would be injured, practice and competition of some group 3 sports may be considered at the neurologist's discretion following in-depth medical/neurologic assessment after 12 months of follow-up, provided their seizure frequency is sufficient to confirm the exclusively sleep-related occurrence of seizures, informed consent is obtained, and appropriate medical surveillance and supervision during the activity are ensured.

PWEs continuing to have seizures without impaired awareness

PWEs with seizures without loss of consciousness or impaired awareness may immediately practice and compete in group 1 sports. They may also be considered fit to practice and compete immediately in some group 2 sports (e.g., swimming and canoeing), at the neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. In agreement with the 2009 EU Commission Directive for driving,[31] they may practice and compete in all group 2 sports after 12 months of follow-up, provided their seizure frequency is sufficient to confirm the consistency of the clinical semiology. They should not practice or compete in group 3 sports that pose a danger to others. However, in those sports in which only the PWE would be injured, practice and competition of some group 3 sports may be considered at the neurologist's discretion following in-depth medical/neurologic assessments after 12 months of follow-up, provided seizure frequency is sufficient to confirm consistent ictal semiology, informed consent is obtained, and appropriate medical surveillance and supervision during the activity are ensured.

PWEs continuing to have seizures with impaired awareness

PWEs with uncontrolled seizures associated with impaired awareness may practice and compete in group 1 sports unless the activity involves exposure to specific seizure precipitating factors, as in the case of some reflex epilepsies. They may also be considered fit to practice and compete in some group 2 sports at the neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. They should not practice or compete in group 3 sports that pose a danger to others. However, in sports in which only the PWE would be injured, practice and competition of specific group 3 sports may be considered with informed consent and at the neurologist's discretion under exceptional circumstances, e.g., when appropriate medical surveillance and supervision during the activity can be ensured and in depth medical/neurologic assessments allow to exclude an excessive risk of seizure-related harm.

People in whom the epilepsy has resolved

According to the ILAE definition, the epilepsy can be considered resolved when seizure-free individuals "either had an age-dependent epilepsy syndrome but are now past the applicable age or have remained without seizures for the last 10 years and are off antiseizure medicines for at least the last 5 years."[32,33] These people may practice and compete in all sports.

Medication withdrawal

The preceding recommendations apply irrespective of whether a person with epilepsy is receiving antiepileptic drug (AED) treatment. With respect to the implications of treatment, PWEs should be alerted that changes in antiepileptic medications should always be done under close medical supervision. They should also be informed that reduction or withdrawal of AED treatment involves a risk of seizure recurrence, which varies in relation to the epilepsy syndrome, previous duration of seizure freedom, and other factors. In PWEs who are undergoing (or underwent) reduction or withdrawal of AED therapy, neurologists and sports specialists need to consider the individual risks of seizure recurrence when making decisions in relation to practice and competition in specific sports. In agreement with the EU driving Directive, PWEs who are seizure-free should not engage in group 2 and group 3 sports from the commencement of the period of AED withdrawal and thereafter for a period of 6 months after cessation of treatment. PWEs who had recurrence of seizures during physician-advised treatment change or AED withdrawal should not engage in group 2 and group 3 sports for a period of 3 months after the previously effective treatment is reinstated and no further seizures occurred in this period. Some flexibility to these recommendations may be exerted at neurologist's discretion, according to the principles outlined in earlier sections of this article.

Conclusions

Engaging in physical exercise and sport activities has positive medical and psychosocial effects for PWEs, including increased self-esteem, socialization, and improvement in long-term general health. However, historically, restrictions have often hampered the participation of PWEs in sports.[1–3] There are limited data as to which sports involve specific risks for PWEs and how specific risks vary in relation to seizure frequency and seizure type. This article provides suggestions for clinical advice and for the issuance of certificates of fitness for sports based on presumed risk for different categories of sports as well as clinical conditions, in order to maximally allow PWEs to practice and compete in sports without compromising their safety and that of others. The suggestions are applicable to the practice of sports at either the amateur or the professional level, because distinction between the two levels of participation cannot be justified based on available evidence. The suggestions are also valid for all age groups. Indeed, children and adolescents should not be restrained from and are encouraged to take part in sport activities at school or recreational sports considering the risk classifications in the present article and under appropriate supervision. These suggestions are directed to all physicians and other health care professionals involved in the treatment of PWEs. The ILAE Task Force on Sports and Epilepsy acknowledges the multifaceted aspects of sports and exercise participation by PWEs; therefore, this consensus report strives to be both cautious and permissive. Because of the lack of well-controlled studies and the paucity of observational data, recommendations are opinion based, utilizing as a primary reference EU driving regulations.[31] Therefore, the Task Force considers this document as a work in progress that will need to be updated periodically as results of much-needed research on this topic become available, leading in the future to evidence-based guidelines. In addition, it is envisaged that future versions of this document will benefit from collaboration with international sports federations.

Disclosure of Conflict of Interest

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